User's Manual

DL850E/DL850EV ScopeCorder Real Time Math (/G3)/ Power Math (/G5)



IM DL850E-51EN 7th Edition Thank you for purchasing the DL850E ScopeCorder or DL850EV ScopeCorder Vehicle Edition (hereinafter, "DL850E/DL850EV" will refer to both of these products).

This User's Manual explains the real time math and power math features. To ensure correct use, please read this manual thoroughly before beginning operation.

Keep this manual in a safe place for quick reference in the event a question arises.

List of Manuals

The following manuals, including this one, are provided as manuals for the DL850E/DL850EV. Please read all manuals.

Manual Title	Manual No.	Description
DL850E/DL850EV ScopeCorder Features Guide	IM DL850E-01EN	The supplied CD contains the PDF file of this manual. This manual explains all the DL850E/DL850EV features other than the communication interface features.
DL850E/DL850EV ScopeCorder User's Manual	IM DL850E-02EN	The supplied CD contains the PDF file of this manual. The manual explains how to operate the DL850E/DL850EV.
DL850E/DL850EV ScopeCorder Getting Started Guide	IM DL850E-03EN	This guide explains the handling precautions and basic operations of the DL850E/DL850EV.
DL850E/DL850EV ScopeCorder Communication Interface User's Manual	IM DL850E-17EN	The supplied CD contains the PDF file of this manual. This manual explains the DL850E/DL850EV communication interface features and how to use them.
DL850E/DL850EV ScopeCorder Real Time Math/Power Math User's Manual	IM DL850E-51EN	This manual. The supplied CD contains the PDF file of this manual. This manual explains the features of the DL850E/DL850EV Real Time Math/Power Math option and how to use them.
DL850E/DL850EV ScopeCorder Acquisition Software User's Manual	IM DL850E-61EN	The supplied CD contains the PDF file of this manual. This manual explains all the features of the acquisition software, which records and displays data measured with the DL850E/DL850EV on a PC.
Precautions Concerning the Modules	IM 701250-04E	The manual explains the precautions concerning the modules. This manual is included if you ordered modules.
Model DL850E ScopeCorder, Model DL850EV ScopeCorder Vehicle Edition, User's Manual	IM DL850E-92Z1	Document for China

The "EN", "E", "Z1" and "Z2" in the manual numbers are the language codes.

Contact information of Yokogawa offices worldwide is provided on the following sheet.

Document No.	Description
PIM 113-01Z2	List of worldwide contacts

Regarding the Conventional DL850 and DL850V

The DL850E/DL850EV manuals also cover how to use the conventional DL850/DL850V (firmware version 3.0 and later).

In the explanations, the model is indicated as DL850E/DL850EV, but if you are using the DL850/DL850V, read "DL850E" as "DL850" and "DL850EV" as "DL850V." The following options are available only for the DL850E/DL850EV. They cannot be used with the DL850 or DL850V.

- Power math (/G5 option)
- GPS interface (/C30 option)

Notes

- The contents of this manual are subject to change without prior notice as a result of continuing improvements to the instrument's performance and functionality. The figures given in this manual may differ from those that actually appear on your screen.
- Every effort has been made in the preparation of this manual to ensure the accuracy of its contents. However, should you have any questions or find any errors, please contact your nearest YOKOGAWA dealer.
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- 5th Edition: July 2017
- 6th Edition: November 2017
- 7th Edition: April 2018

Conventions Used in This Manual

Notes and Cautions

The notes and cautions in this manual are categorized using the following symbols.



Attire l'attention sur des gestes ou des conditions susceptibles de provoquer des blessures légères ou d'endommager l'instrument ou les données de l'utilisateur, et sur les précautions de sécurité susceptibles de prévenir de tels accidents.

Note Calls attention to information that is important for proper operation of the instrument.

Unit

k	Denotes 1000. Example: 100 kS/s (sample rate)
K	Denotes 1024. Example: 720 KB (file size)

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Features

1

The digital filter, delay, and real time math features can be used on DL850E/DL850EVs with the / G3 option. The /G5 option expands the real time math feature to include power math and harmonic analysis.

- You can set a digital filter or delay on input channel waveforms (A/D converted data). You can also
 perform real time math operations in which the waveforms of input channels or the results of other
 real time math operations are used as the math source waveforms.
- The results of filtering and math operations are acquired in acquisition memory—the same place that input channel waveforms are acquired.
- You can perform filtering and math operations on up to 16 channels at the same time.
- By setting the waveform that results from filtering or math operations as a trigger source, you can trigger the DL850E/DL850EV on the results.



Digital Filter and Delay (Filter/Delay Setup)

You can set digital filters and delays on input channel waveforms (A/D converted data). This is one of the features of the /G3 and /G5 option.

- Configure the settings for each channel. You can perform filtering on up to 16 channels at the same time.
- Even during waveform acquisition, you can set the filter type, filter band, and cutoff frequency.
- The digital filter/delay setup menu is displayed when the real time math menu is turned off.
- To enable the digital filter/delay feature and the real time math feature at the same time, you have to first configure the digital filter/delay settings, and then turn the real time math menu on.
- You cannot set digital filters or delays on the bits or input channels of a logic, 16-CH voltage input, 16-CH temperature/voltage input, CAN bus monitor, CAN & LIN bus monitor, CAN/CAN FD monitor, SENT monitor, or 4-CH module.
- By setting the waveform that results from filtering as a trigger source, you can trigger the DL850E/ DL850EV on the results.
- · For details on the digital filter characteristics, delay, and settings, see the appendix.

Bandwidth (Bandwidth)

When you set a filtering feature, it takes effect immediately.

- Digital (Digital): Select this item to display a menu for configuring the optional digital filter.
- LPF: Select this item to display a menu for configuring the standard filter.
 For details on the standard filter feature, see the *Features Guide*, IM DL850E-01EN.

Filter Type (Filter Type)

The following digital filter types are available: Gauss, Sharp, IIR, Mean and IIR-Lowpass. The features of each filter are listed below.

Filter Type	Fea	atures	Operation Type	
Gauss	•	Frequency characteristics with a smooth attenuation slope	FIR	
	•	Linear phase and constant group delay		
	•	No ripples present in the passband		
	•	No overshoot in the step response		
	•	Low order and short delay		
Sharp	•	Frequency characteristics with a sharp attenuation slope	FIR	
		(–40 dB at 1 oct)		
	•	Linear phase and constant group delay		
	•	Ripples present in the passband		
	•	Comb-shaped stopband		
IIR	•	Attenuation slope steepness between those of the SHARP and	IIR	
		GAUSS filters		
	•	Non-linear phase and non-constant group delay		
	•	No ripples present in the passband and stopband		
	•	Characteristics similar to those of analog filters		
	•	Compared to Sharp and Gauss filters, lower cutoff frequency		
		possible		
Mean	•	Comb-shaped frequency characteristics	FIR	
	•	Linear phase and constant group delay		
	•	No overshoot in the step response		
IIR-Lowpass	•	Computes at 10 MS/s regardless of the setting.	IIR	

Filter Band (Filter Band)

When the filter type is set to Gauss, Sharp, or IIR, you can select the filter band. The type of filter band that you can select depends on the filter type.

Filter Type	Filter Band	
Gauss	Low-Pass	
Sharp	Low-Pass, High-Pass, Band-Pass	
lir	Low-Pass, High-Pass, Band-Pass	

Cutoff Frequency (CutOff)

When the filter type is set to Sharp, Gauss, or IIR and the filter band is set to Low-Pass or High-Pass, you can set the cutoff frequency. The ranges and resolutions are indicated below.

Filter Type	Filter Band	Range	Resolution
Gauss	Low-Pass	0.002 kHz to 300 kHz	0.0002 kHz (0.002 kHz to 0.0298 kHz range)
		Default value: 300 kHz	0.002 kHz (0.03 kHz to 0.298 kHz range)
			0.02 kHz (0.30 kHz to 2.98 kHz range)
			0.2 kHz (3.0 kHz to 29.8 kHz range)
			2 kHz (30 kHz to 300 kHz range)
Sharp	Low-Pass	0.002 kHz to 300 kHz	0.0002 kHz (0.002 kHz to 0.0298 kHz range)
		Default value: 300 kHz	0.002 kHz (0.03 kHz to 0.298 kHz range)
			0.02 kHz (0.30 kHz to 2.98 kHz range)
			0.2 kHz (3.0 kHz to 29.8 kHz range)
			2 kHz (30 kHz to 300 kHz range)
	High-Pass	0.20 kHz to 300 kHz	0.02 kHz (0.20 kHz to 2.98 kHz range)
		Default value: 300 kHz	0.2 kHz (3.0 kHz to 29.8 kHz range)
			2 kHz (30 kHz to 300 kHz range)
IIR	Low-Pass	0.002 kHz to 300 kHz	0.002 kHz (0.002 kHz to 0.298 kHz range)
		Default value: 300 kHz	0.02 kHz (0.30 kHz to 2.98 kHz range)
			0.2 kHz (3.0 kHz to 29.8 kHz range)
			2 kHz (30 kHz to 300 kHz range)
	High-Pass	0.02 kHz to 300 kHz	0.02 kHz (0.02 kHz to 2.98 kHz range)
		Default value: 300 kHz	0.2 kHz (3.0 kHz to 29.8 kHz range)
			2 kHz (30 kHz to 300 kHz range)

Filter Type	Filter Band	Range	Resolution
IIR-Lowpass	Low-Pass	128 kHz, 64 kHz, 32 kHz, 16 kHz, 8 kHz, 4 kHz, 2 kHz, 1 kHz, 500 Hz, 250 Hz, 125 Hz, 62 5 Hz	-
		Default value: 128 kHz	

Center Frequency (Center Frequency)

When the filter type is set to Sharp or IIR and the filter band is set to Band-Pass, set the center

frequency. The ranges and resolutions are indicated below.

Filter Type	Range	Resolution
Sharp	0.30 kHz to 300 kHz	0.02 kHz (0.30 kHz to 2.98 kHz range)
	Default value: 300 Hz	0.2 kHz (3 kHz to 29.8 kHz range)
		2 kHz (30 kHz to 300 kHz range)
lir	0.06 kHz to 300 kHz	0.02 kHz (60 Hz to 1.18 kHz range)
	Default value: 300 Hz	0.2 kHz (1.2 kHz to 11.8 kHz range)
		2 kHz (12 kHz to 300 kHz range)

Bandwidth (Pass Band)

When the filter type is set to Sharp or IIR and the filter band is set to Band-Pass, set the bandwidth. The bandwidth options vary depending on the center frequency that you have set. For details about these options, see the appendix.

Tap (Tap)

When the filter type is set to Mean, select the number of taps (number of levels) from the following options. The larger the number of taps, the sharper the filter characteristics become. 2, 4, 8, 16, 32, 64, 128

Mean Sample Rate (Mean Sample)

When the filter type is set to Mean, select the sample rate from the following options. The specified sample rate is used to sample waveforms and to filter them. 1 M, 100 k, 10 k, 1 k (unit: S/s)

Interpolation On and Off (Interpolate)

Select whether to perform data interpolation when the filter type is Gauss, Sharp, IIR, or Mean (moving average). Select whether to perform data interpolation. Up to 10 M samples of data can be interpolated from the data of waveforms that pass through the digital filter. The interpolation method is linear interpolation.

- ON: Data is interpolated.
- OFF: Data is not interpolated.

Delay (Delay)

You can set a delay on waveforms that pass through the digital filter.

The sampling data is decimated in a simple manner to produce the data delay. Consequently, if you set a large delay, data updating automatically becomes slower. The default value is $0.0 \ \mu s$.

Range	Resolution	Data Update Frequency
0.0 µs to 100 µs	0.1 µs	10 MHz
101 µs to 1.00 ms	1 µs	1 MHz
1.01 ms to 10.00 ms	0.01 ms	100 kHz

Note.

The delay is valid even if you are not using the digital filter. However, if you set a delay, the sampling data automatically passes through the digital filter circuit. Therefore, the actual delay when you are not using the digital filter is 1.4 μ s (the minimum math delay) + the set delay.

Real Time Math (RealTime Math)

Turning Real Time Math On and Off

Select whether to use real time math.

- ON: Select this item to display a menu for configuring real time math. At the same time, real time
 math execution begins.
- OFF: Select this item to display a menu for configuring the standard model. Real time math is not executed.

For details on the features of the standard model, see the Features Guide, IM DL850E-01EN.

You can perform real time math operations in which the waveforms of input channels or the results of other real time math operations are used as the math source waveforms. This is one of the features of the /G3 option.

- Configure the settings for each channel. You can perform math operations on up to 16 channels at the same time.
- When you turn real time math on, the real time math results are output to the real time math channels (the channels that you have turned math on for). The waveforms of input channels whose math is turned on are not used for displaying, saving, triggering, or analyzing (cursor measurement, automated measurement of waveform parameters, math computation, FFT, GO/NO-GO, search, history, power math of the /G5 option, etc.). For example, if you turn real time math on for input channel CH2, CH2 becomes the RMath2 real time math channel, and the math results are displayed on the screen. The data that is saved is that of the math result. If you want to display, save, trigger on, or analyze the waveform of the input channel, set the real time math to a channel that has no input.
- Waveforms of real time math channels (real time math results) are used for displaying, saving, triggering, and analyzing (except for power math).
- Other real time math channels can be used as source waveforms of real time math. If you set the real time math channel to RMathX, you can select the RMath waveforms on channels up to RMathX–1. If the real time math channel is RMath1, you cannot use any other RMath waveforms as math source waveforms.
- You cannot set the channel that the real time math result is output on to an input channel of a 16-CH voltage input, 16-CH temperature/voltage input, CAN bus monitor, CAN & LIN bus monitor, or SENT monitor module (there is no menu for turning real time math on).
- The input channel of a 16-CH voltage input, 16-CH temperature/voltage input, CAN bus monitor, CAN & LIN bus monitor, CAN/CAN FD monitor, SENT monitor, or 4CH^{*} module can be used as a source waveform of real time math.
 - * 4-CH module input channels have sub channels 1 and 2. If real time math is turned off, both sub channels 1 and 2 can be selected. If real time math of a 4-CH module is turned on, either sub channel 1 or 2 of that module becomes the output destination of the real time math results. For example, if sub channel 1 is set to CH3_1 and sub channel 2 to CH3_2 and real time math is turned on, the channel becomes a single real time math channel named RMath3, and only CH3_1 is displayed for the source waveform option.
- Of the power math of the /G5 option, CH13 and CH14 if power analysis is in use and CH15 and CH16 if harmonic analysis is in use cannot be used as real time math channels or sources.
- For details on the modules whose channels you can set as real time math sources, see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.
- Even during waveform acquisition, you can set various math conditions, such as the operator
 or function (the operation definition), the source waveforms, and the coefficients. However, if
 you change the conditions, the measurement count (waveform acquisition count) is reset. The
 measurement count is displayed in the lower left of the screen. In roll mode during waveform
 acquisition, real time math cannot be turned on and off.
- · For details on the math expressions, delay, and settings, see the appendix.

Labels (Label)

This is the same as the feature on the standard model. For details, see the *Features Guide*, IM DL850E-01EN.

Real Time Math Setup (RealTime Math Setup)

Select an operator or function (operation definition), and then set its corresponding items.

Operators and Functions (Operation)

- S1+S2: Adds the waveforms assigned to Source1 and Source2
- S1–S2: Subtracts the waveform assigned to Source2 from the waveform assigned to Source1
- S1*S2: Multiplies the waveforms assigned to Source1 and Source2
- S1/S2: Divides the waveform assigned to Source1 by the waveform assigned to Source2
- A(S1)+B(S2)+C: Performs addition with coefficients on the waveforms assigned to Source1 and Source2
- A(S1)–B(S2)+C: Performs subtraction with coefficients on the waveforms assigned to Source1 and Source2
- A(S1)*B(S2)+C: Performs multiplication with coefficients on the waveforms assigned to Source1 and Source2
- A(S1)/B(S2)+C: Performs division with coefficients on the waveforms assigned to Source1 and Source2
- Diff(S1): Performs differentiation on the waveform assigned to Source using a fifth order Lagrange interpolation formula
- Integ1(S1): Performs integration on the positive component of the waveform assigned to Source
- Integ2(S1): Performs integration on the positive and negative components of the waveform assigned to Source
- Rotary Angle: Uses the waveforms or logic signals that have been assigned to phases A, B, and Z to calculate the angle of rotation. This can be used to calculate the angle of rotation or the displacement of an encoder.
- DA: Converts the logic signals that have been assigned to Source1 (the least significant digits) and Source2 (the most significant digits) into an analog waveform and scales the results
- Polynomial: Performs a quartic polynomial calculation on the waveform that has been assigned to Source
- · RMS: Calculates the RMS value of the waveform that has been assigned to Source
- Power: Calculates the effective power of the waveforms that have been assigned to Source1 and Source2
- Power Integ: Integrates the effective power of the waveforms that have been assigned to Source1 and Source2.
- Log1: Calculates the common logarithm of the waveforms that have been assigned to Source1 and Source2 (the calculation is performed on "Source1/Source2")
- Log2: Calculates the common logarithm of the waveform that has been assigned to Source
- Sqrt1: Calculates the square root of the sum (or difference) of the squares of the waveforms that have been assigned to Source1 and Source2. This can be used to analyze displacement and tolerance.
- · Sqrt2: Calculates the square root of the waveform that has been assigned to Source
- Cos: Uses the waveforms or logic signals that have been assigned to phases A, B, and Z to
 determine the angle, and then calculates the cosine of this angle. You can use this to convert the
 angle to displacement.
- Sin: Uses the waveforms or logic signals that have been assigned to phases A, B, and Z to determine the angle, and then calculates the sine of this angle. You can use this to convert the angle to displacement.
- Atan: Calculates the arc tangent of the waveforms that have been assigned to Source1 and Source2 (the calculation is performed on "Source1/Source2"). You can use this to convert the displacement to an angle.
- Electrical Angle: Calculates the phase difference between (1) the angle that was determined from the logic signals that were specified for phases A, B, and Z, and (2) the fundamental component that was determined from the discrete Fourier transform of the waveform that was specified as the target. You can calculate the phase difference (electrical angle) between the motor's angle of rotation and the motor drive current.
- Knock Filter (can only be set on the DL850EV): When the signal level of the waveform that has been set to Source is less than or equal to the elimination level, the signal of this waveform is set to 0. You can select whether to perform differentiation. You can use this to extract knocking.

1

Features

- Poly-Add-Sub: Performs addition or subtraction or both on the waveforms that have been set to Source1, Source2, Source3, and Source4. You can add or subtract the result of the power calculation, to calculate the multi-phase power.
- · Frequency: Calculates the frequency of the waveform that has been assigned to Source
- · Period: Calculates the period of the waveform that has been assigned to Source
- Edge Count: Counts the number of slope edges of the waveform that has been assigned to Source. You can use this to count the number of events in consecutive tests.
- Resolver: Calculates the angle of rotation from the sine signal and cosine signal that are generated from the detection coils of the resolver depending on the angle of the rotor.
- IIR Filter: This can be used to filter the waveform that has been set to Source with the same characteristics of the IIR filter of the digital filter. You can set the frequency to values over a wider range than is available with the IIR filter of a digital filter.
- PWM: Integrates a pulse width modulation signal and demodulates it to an analog signal.
- Reactive Power(Q): Calculates the reactive power from apparent power and effective power.
- · CAN ID: Detects the frame of the CAN bus signal with the specified ID.
- Torque: Measures the frequency of the pulse frequency output torque sensor and calculates the torque using the specified coefficient.
- S1–S2(Angle): Determines the angle difference by subtracting the Source 2 angle from the Source 1 angle.
- 3 Phase Resolver: Calculates the angle of rotation from the two sine signals that are generated from the detection coil of the 3 phase resolver depending on the angle of the rotor.

Turning the Mean On and Off (Mean)

Select whether to perform the mean. This mean is the same feature as the one in the digital filter. However, the number of taps is fixed to 32. The sampling frequency is the same as the DL850E/ DL850EV sample rate. The maximum sampling frequency is 10 MHz.

- · ON: The mean is performed.
- OFF: The mean is not performed.

Optimizing Value/Div (Optimize Value/Div)

Press the Optimize Value/Div soft key to automatically set the value/div that the DL850E/DL850EV determines is the most appropriate for the math source waveform range and the expression. The selected value is from among the 123 value/div options for vertical axis sensitivity.

- The automatically selected option does not line up with the input values and math results, so you
 need to use the SCALE knob to change the value/div.
- There are a total of 123 value/div options within the following range: 500.0E+18 to 10.00E-21 (in steps of 1, 2, or 5).

Waveform Vertical Position (Vertical POSITION knob)

This is the same as the feature on the standard model. For details, see the *Features Guide*, IM DL850E-01EN.

Zoom Method (V Scale), Zooming by Setting a Magnification (V Zoom), Zooming by Setting Upper and Lower Display Limits (Upper/Lower)

This is the same as the feature on the standard model. For details, see the *Features Guide*, IM DL850E-01EN.

Offset (Offset)

This is the same as the feature on the standard model. For details, see the *Features Guide*, IM DL850E-01EN.

Trace Settings (Trace Setup)

This is the same as the feature on the standard model. For details, see the *Features Guide*, IM DL850E-01EN.

Unit (Unit)

You can assign a unit of up to four characters in length to the math results. The specified unit is reflected in the scale values.

All Channels Setup Menu

There is a menu (ALL CH) that is used to configure the settings for all channels for real time math. The menu is operated in the same way as the all channels setup menu on the standard model.

- · You can configure the real time math settings of all channels while viewing the settings in a list.
- You can turn real time math on and off for all channels at once.
- There are some items that cannot be configured from the ALL CH menu.

Basic Arithmetic (S1+S2, S1–S2, S1*S2, and S1/S2)

Performs addition, subtraction, multiplication, or division on the two waveforms assigned to Source1 and Source2.

Math Source Waveforms (Source1 and Source2)

CH1 to CH16,¹ 16chVOLT,² 16chTEMP/VOLT,² CAN,³ LIN,³ SENT,³ RMath1 to RMath15⁴

- 1 You can select input channels of installed modules. On a 4-CH module, select sub channel 1 or 2. You cannot select the input channel of a logic module. However, you cannot select input channels of a logic module.
- 2 When a 16-CH voltage input module or 16-CH temperature/voltage input module is installed. After you select 16chVOLT or 16chTEMP/VOLT, select a sub channel.
- 3 On a DL850EV when a CAN bus monitor, CAN & LIN bus, CAN/CAN FD monitor, or SENT monitor module is installed. After you select CAN, LIN, or SENT, select a sub channel. This cannot be selected on a CAN bus monitor, CAN & LIN bus monitor or CAN/CAN FD monitor module if the data type (Value Type) is set to Logic. Even if the data type is not set to Logic, you cannot use data that exceeds 16 bits in length. On a SENT monitor module, S&C and Error Trigger sub channels cannot be selected.
- 4 You can use other RMath waveforms as math source waveforms. If you set the real time math channel to RMathX, you can select the RMath waveforms on channels up to RMathX–1. If the real time math channel is RMath1, you cannot use any other RMath waveforms as math source waveforms.

Basic Arithmetic with Coefficients (A(S1)+B(S2)+C, A(S1)–B(S2)+C, A(S1)*B(S2)+C, A(S1)/B(S2)+C)

Performs addition, subtraction, multiplication, or division with coefficients on the two waveforms assigned to Source1 and Source2.

Math Source Waveforms (Source1 and Source2)

The options are the same as were described above for basic arithmetic. For details, see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

Coefficients (A, B, and C)

Set the scaling coefficients (A and B) and the offset (C). Range: -9.9999E+30 to +9.9999E+30 Default value of A and B: 1.0000 Default value of C: 0.0000

Differentiation (Diff(S1))

Performs differentiation on the waveform assigned to Source using a fifth order Lagrange interpolation formula. For details on the differentiation characteristics, see the appendix.

Math Source Waveform (Source)

The options are the same as were described above for basic arithmetic. For details, see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

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Integration (Integ1(S1) and Integ2(S1))

Integration is performed on the waveform that has been assigned to Source.

- · Integ1(S1): Performs integration on the positive component of the waveform assigned to Source
- Integ2(S1): Performs integration on the positive and negative components of the waveform assigned to Source

Math Source Waveform (Source)

The options are the same as were described above for basic arithmetic. For details, see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

Reset Condition (Reset Condition)

- Select the condition for resetting integration from one of the settings below.
- · Start (Start): When the waveform acquisition starts
- Overlimit (Overlimit): When "Value/Div" exceeds +10 div or falls below -10 div
- Zero crossing (ZeroCross): When the math source waveform signal crosses zero Set the slope direction (positive or negative) and the hysteresis when the signal crosses zero. The hysteresis level is the same as the trigger hysteresis. For details, see the *Features Guide*, IM DL850E-01EN.

Manual Reset (Manual Reset)

To manually reset the integration, select Execute.

Angle of Rotation (Rotary Angle)

Uses the waveforms or logic signals that have been assigned to phases A, B, and Z to calculate the angle of rotation. This can be used to calculate the angle of rotation or the displacement of an encoder.

Type (Type)

You can select the type of the encoding from the following options.

- Incremental ABZ (Incremental ABZ): The angle of rotation is calculated from the A, B, and Z phase signals.
- Incremental AZ (Incremental AZ): The angle of rotation is calculated from the A and Z phase signals.
- Absolute 8 bit (Absolute 8bit): The angle of rotation is calculated from an 8-bit logic signal (binary code).
- Absolute 16 bit (Absolute 8bit): The angle of rotation is calculated from a 16-bit logic signal (binary code).
- Gray code (Gray Code): The angle of rotation is calculated from a logic signal (gray code) consisting of 2 to 16 bits.

Source Conditions (Source Condition)

Set the conditions of the source whose pulses you want to count.

If the type of the encoding is ABZ or AZ

- Turning the logic source on and off (Logic Source)
 - ON: You can set the A, B, and Z phase signals to the signals of logic modules.
 - OFF: You can set the A, B, and Z phase signals to the signals of analog waveform modules. The options are the same as were described above for basic arithmetic. However, you cannot select input channels of frequency modules or real time math channels (RMath). For details,see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

When logic sources are turned on

- Source (Source): Select an input channel of a logic module.
- Phase A (Phase A): Select the bit that you want to use for the phase A signal from among the logic signals of the selected input channel.
- Phase B (Phase B): Select the bit that you want to use for the phase B signal from among the logic signals of the selected input channel.
- Phase Z (Phase Z): Select the bit that you want to use for the phase Z signal from among the logic signals of the selected input channel. You can also select whether the phase Z input is inverted.

· When logic sources are turned off

Set the input channels for the phase A, B, and Z signals,¹ the signal level of each signal that you will count as a pulse,² and the hysteresis of each signal.³

- Phase A (Phase A): Set the input channel, signal level, and hysteresis of the phase A signal.
- Phase B (Phase B): Set the input channel, signal level, and hysteresis of the phase B signal.
- Phase Z (Phase Z): Set the input channel, signal level, and hysteresis of the phase Z signal. You can also select whether the phase Z input is inverted.

To set the timing that pulses are counted and the timing that the pulse count is reset for the signal level that you set here, see "Encoding Conditions" later in this section.

- 1 The options are the same as were described above for basic arithmetic. However, you cannot select input channels of frequency modules or real time math channels (RMath). For details,see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.
- 2 The signal level range is the same as the trigger level range. For details, see the *Features Guide*, IM DL850E-01EN.
- 3 The hysteresis level is the same as the trigger hysteresis. For details, see the *Features Guide*, IM DL850E-01EN.

If the type of the encoding is absolute 8 bit, absolute 16 bit, or gray code

Select the input channel of the logic module. For absolute 16 bit and gray code encoding, set the logic channel for the least significant digits to Source1 and the logic channel for the most significant digits to Source2.

* When the bit length of Gray Code is 8 or less, the Source2 setting is ignored.

Negative Logic ON/OFF (Negative logic)

Select which bit state will be recognized to be logic I.

- ON: Negative logic (low state is logic I)
- OFF: Positive logic (high state is logic I)

Pulses per Rotation (Pulse/Rotate)

Set the number of pulses per rotation.

Range: 1 to 500000. The default value is 180.

However, if the encode type is absolute 8 bit, the maximum number is 256. If the type is absolute 16 bit, the maximum is 65536.

Bit Length (Bit Length)

When the bit length (Bit Length) encoding type is set to Gray Code, set the bit length. Selectable range: 2 to 16

Scaling (Scaling)

Select the unit that is used on the vertical scale.

- · Radian: Radian
- Degree: Degrees
- User-defined (User Define): Set K, the size of the scale.
 Range: -9.9999E+30 to +9.9999E+30. The default value is 1.0000.

Encoding Conditions (Encode Condition)

If the type of the encoding is ABZ or AZ, set the encoder's pulse multiplier and the timing (edge) for counting pulses.

Count Conditions (Count Condition)

You can select the encoder's pulse multiplier from the following options.

×4, ×2, ×1

When the multiplier is ×4, regardless of the timing setting made in the next section, pulses are counted on all the edges of the signal.

Timing1 (Timing1)

Select the edges that are counted as pulses when the multiplier is ×1.

- A *f*: Rising edge of the phase A signal
- A L: Falling edge of the phase A signal
- B *f*: Rising edge of the phase B signal
- B L: Falling edge of the phase B signal Rising edge: The point where the signal rises from a low level and passes through the specified

signal level

Falling edge: The point where the signal falls from a high level and passes through the specified signal level

If the signal is that of an analog waveform, turn the logic sources off as shown earlier this manual in "Source Conditions," and then set the signal level that is counted as a pulse and the hysteresis.

Timing2 (Timing2)

Select the edges that are counted as pulses when the multiplier is ×2.

The options are the same as were described above for Timing1.

When the multiplier is ×2, if you select the same edges as in Timing1, the pulse count conditions are the same as were explained for multiplier ×1.

Reset Timing (Reset Timing)

Select the timing (edge) at which the pulse count will be reset.

- A **f**: Rising edge of the phase A signal
- A L: Falling edge of the phase A signal
- B f: Rising edge of the phase B signal
- B ૨: Falling edge of the phase B signal
- Z level (Z Level): When the Z phase signal is at a high level.

Reverse (Reverse)

Set the direction that the angle of rotation increases in.

- ON: The rotation is counter-clockwise.
- OFF: The rotation is clockwise.

Manual Reset (Manual Reset)

To manually reset the angle of rotation, select Execute.

Logic Signal to Analog Waveform Conversion (DA)

Converts the logic signals that have been assigned to Source1 (the least significant digits) and Source2 (the most significant digits) into an analog waveform and scales the results. You cannot select the input channels of CAN bus monitor, CAN & LIN bus monitor, CAN/CAN FD monitor, or SENT monitor modules.

Math Source Waveforms (Source1 and Source2)

You can select input channels of an installed logic module. Set the logic channel for the least significant digits to Source1 and the logic channel for the most significant digits to Source2. You cannot select the input channels of CAN bus monitor modules, CAN & LIN bus monitor, or CAN/CAN FD monitor modules.

Type (Type)

Select the type of the logic signal.

- Unsigned: Unsigned integer
- Signed: Signed integer
- Offset Binary: Offset binary

Bit Length (Bit Length)

Set the bit length that will be converted to an analog signal. The length that you specify will be counted from the least significant bit.

Range: 2 to 16. The default value is 16.

Coefficient (K)

Set scaling coefficient K. Range: -9.9999E+30 to +9.9999E+30. The default value is 1.0000.

Quartic Polynomial (Polynomial)

Performs a quartic polynomial calculation on the waveform that has been assigned to Source.

As⁴+Bs³+Cs²+Ds+E

- A, B, C, and D: Scaling coefficients
- s: Sampling data
- E: Offset

Math Source Waveform (Source)

The options are the same as were described above for basic arithmetic. For details,see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

Coefficients (A, B, C, D, and E)

Set the scaling coefficients (A, B, C, and D) and the offset (E). Range: -9.9999E+30 to +9.9999E+30 Default value of A and B: 1.0000 Default value of C, D, and E: 0.0000

RMS Value (RMS)

Calculates the RMS value of the waveform that has been assigned to Source.

$$\sqrt{\frac{1}{N}\sum_{n=1}^{N}s(n)^2}$$

s: Sampling data N: Number of samples

Math Source Waveform (Source)

The options are the same as were described above for basic arithmetic. However, you cannot select an input channel of a frequency module. For details, see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

Calculation Period (Calc Period)

Select the method that is used to determine the RMS calculation period.

- · Edge: Rising or falling edge of the selected signal or both edges
- Time: Specified time

If the Calculation Period Is Edge

Edge detection source (Edge Source)

Select the input channel of the signal that is used to determine the calculation period. If you want to use the same channel as the math source waveform, select Own. You can also select other channels. For details,see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

• Level (Level), Slope (Slope), and Hysteresis (Hysteresis)

Set the signal level,¹ the slope (rising or falling), and the hysteresis² of the edges that separate the calculation periods.

- 1 The signal level range is the same as the trigger level range. For details, see the *Features Guide*, IM DL850E-01EN.
- 2 The hysteresis level is the same as the trigger hysteresis. For details, see the *Features Guide*, IM DL850E-01EN.

If the Calculation Period Is Time

Time (Time)

Set the calculation period time. Range: 1 ms to 500 ms. Default value: 1 ms. Resolution: 1 ms.

Effective Power (Power)

Calculates the effective power of the waveforms that have been assigned to Source1 and Source2.

$$\frac{1}{T}\int_{0}^{T}(s1\cdot s2)dt$$

T: 1 period (calculation period)

s1 and s2: Sampling data

dt: Sampling period

Math Source Waveforms (Source1 and Source2)

Set the voltage and current input channels to use to calculate the effective power to Source1 and Source2. The options are the same as were described above for basic arithmetic. However, you cannot select input channels of a frequency module. For details, see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

Calculation Period (Calc Period)

Set the calculation period for the effective power calculation.

Select the input channel of the signal that is used to determine the calculation period.

If you want to use the same channel as the math source waveform, select Source1 or Source2. You can also select other channels. For details, see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

Level (Level), Slope (Slope), and Hysteresis (Hysteresis)

Set the signal level, the slope, and the hysteresis of the edges that separate the calculation periods. These settings are shared with the RMS operation.

Effective Power Integration (Power Integ)

Integrates the effective power of the waveforms that have been assigned to Source1 and Source2.

$$\int_{0}^{T} (s1 \cdot s2) dt$$

T: Integration time

- s1 and s2: Sampling data
- dt: Sampling period

Math Source Waveforms (Source1 and Source2)

Set the voltage and current input channels to use to integrate the effective power to Source1 and Source2. The options are the same as were described above for basic arithmetic. However, you cannot select input channels of a frequency module. For details, see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

Reset Condition (Reset Condition)

Select the condition for resetting integration from one of the settings below.

- Start (Start): When the waveform acquisition starts
- Overlimit (Overlimit): When "Value/Div" exceeds +10 div or falls below -10 div

Manual Reset (Manual Reset)

To manually reset the integration, select Execute.

Scaling (Scaling)

Select the unit that is used on the vertical scale.

- Seconds (Second): The unit is seconds.
- Hours (Hour): The unit is hours.

Common Logarithm (Log1 and Log2)

 Log1:Calculates the common logarithm of the waveforms that have been assigned to Source1 and Source2 (the calculation is performed on "Source1/Source2").

 $\label{eq:K-log10} \textbf{K} \cdot \textbf{log_{10}(s1/s2)} \qquad \text{K: Coefficient.} \qquad s1 \text{ and } s2\text{: Sampling data.}$

Log2:Calculates the common logarithm of the waveform that has been assigned to Source.
 K • log₁₀(s)
 K: Coefficient.
 s: Sampling data.

Math Source Waveforms (Source1, Source2, and Source)

The options are the same as were described above for basic arithmetic. For details, see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

Coefficient (K)

Set scaling coefficient K. Range: –9.9999E+30 to +9.9999E+30. The default value is 1.0000. 1

Square Root (Sqrt1 and Sqrt2)

 Sqrt1: Calculates the square root of the sum (or difference) of the squares of the waveforms that have been assigned to Source1 and Source2. This can be used to analyze displacement and tolerance.

 $\sqrt{s1^2 \pm s2^2}$ s1 and s2: Sampling data

· Sqrt2: Calculates the square root of the waveform that has been assigned to Source

√s s: Sampling data

Math Source Waveforms (Source1, Source2, and Source)

The options are the same as were described above for basic arithmetic. For details, see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

Sign (Sign)

Set the operator between s1² and s2² in Sqrt1.

- +: Addition
- -: Subtraction

Cosine (Cos) and Sine (Sin)

Uses the waveforms or logic signals that have been assigned to phases A, B, and Z to determine the angle, and then calculates the cosine or sine of this angle. You can use this to convert the angle to displacement.

Type (Type)

Select the type of the encoding. The settings other than the Resolver Ch setting are shared with the Rotary Angle operation. You can specify the Resolver Ch setting when there is a channel that has been defined with the resolver function of real time math.

- If there are multiple channels that have been defined with the resolver function, select Resolver Ch, and then select the channel.
- · If Resolver Ch has been selected, the setup menu explained later is not displayed.

Source Conditions (Source Condition)

Set the conditions of the source whose pulses you want to count. This setting is shared with the Rotary Angle operation. For details, see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

Pulses per Rotation (Pulse/Rotate) and Bit Length (Bit Length)

Set the number of pulses per rotation. When the encoding type is set to Gray Code, set the bit length. This setting is shared with the Rotary Angle operation.

Encoding Conditions (Encode Condition)

If the type of the encoding is ABZ or AZ, set the encoder's pulse multiplier and the timing (edge) for counting pulses. This setting is shared with the Rotary Angle operation.

Manual Reset (Manual Reset)

To manually reset the computed value, select Execute.

Arc Tangent (Atan)

Calculates the arc tangent of the waveforms that have been assigned to Source1 and Source2 (the calculation is performed on "Source1/Source2"). You can use this to convert the displacement to an angle.

atan(s1/s2) s1 and s2: Sampling data

Math Source Waveforms (Source1 and Source2)

The options are the same as were described above for basic arithmetic. For details, see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

Scaling (Scaling)

Select the unit that is used on the vertical scale. This setting is shared with the Rotary Angle operation. However, there are no user-defined settings.

Quadrant Range (Quadrant)

Select the quadrant range to use for converting displacements to angles. This can be used on models with firmware version 2.05 and later.

- Quadrant-2: -90° to $+90^{\circ}$ ($-\pi/2$ to $+\pi/2$)
- Even if a calculated result is between -180° and -90° or between $+90^{\circ}$ and $+180^{\circ}$, it is converted to an angle between -90° to $+90^{\circ}$.
- Quadrant-4: -180° to $+180^{\circ}$ ($-\pi$ to $+\pi$)

Electrical Angle (Electrical Angle)

Calculates the phase difference between (1) the angle that was determined from the logic signals that were specified for phases A, B, and Z, and (2) the fundamental component that was determined from the discrete Fourier transform of the waveform that was specified as the target. You can calculate the phase difference (electrical angle) between the motor's angle of rotation and the motor drive current.

Type (Type)

Select the type of the encoding. The settings other than the Resolver Ch setting are shared with the Rotary Angle operation. You can specify the Resolver Ch setting when there is a channel that has been defined with the resolver function of real time math.

- If there are multiple channels that have been defined with the resolver function, select Resolver Ch, and then select the channel.
- If Resolver Ch has been selected, set the scaling and the target on the setup menus explained later.

Source Conditions (Source Condition)

Set the conditions of the source whose pulses you want to count. This setting is shared with the Rotary Angle operation. However, you can only specify the input channels of logic modules as math source waveforms. For details, see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

Pulses per Rotation (Pulse/Rotate) and Bit Length (Bit Length)

Set the number of pulses per rotation. When the encoding type is set to Gray Code, set the bit length. This setting is shared with the Rotary Angle operation.

Scaling (Scaling)

Select the unit that is used on the vertical scale. This setting is shared with the Rotary Angle operation. However, there are no user-defined settings.

Encoding Conditions (Encode Condition)

If the type of the encoding is ABZ or AZ, set the encoder's pulse multiplier and the timing (edge) for counting pulses. This setting is shared with the Rotary Angle operation.

Target (Target)

The fundamental component of the waveform that you specify here is determined through a discrete Fourier transform. If the angle is the motor's angle of rotation and the target is the motor's drive current, the electrical angle can be determined.

The options are the same as were described above for basic arithmetic. However, you cannot select an input channel of a frequency module. For details, see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

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Features

Knocking Filter (Knock Filter; only on the DL850EV)

When the signal level of the waveform that has been set to Source is less than or equal to the elimination level, the signal of this waveform is set to 0. You can select whether to perform differentiation. You can use this to extract knocking.



Math Source Waveform (Source)

The options are the same as were described above for basic arithmetic. However, you cannot select an input channel of a frequency module or a real time math channel (RMath). For details, see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

Elimination Level

Set the elimination level, which is used to set the input signal to 0. The range of the elimination level is the same as that of the trigger level. For details, see the *Features Guide*, IM DL850E-01EN.

Differential

Select whether to differentiate the waveform after elimination. A fifth order Lagrange interpolation formula is used to perform differentiation. For details on the differentiation characteristics, see the appendix.

- ON: Differentiation is performed.
- OFF: Differentiation is not performed.

Polynomial with a coefficient (Poly-Add-Sub)

Performs addition or subtraction or both on the waveforms that have been set to Source1, Source2, Source3, and Source4. You can add or subtract the result of the power calculation, to calculate the multi-phase power.

K (±s1 ±s2 ±s3 ±s4) K: Coefficient. s1, s2, s3, and s4: Sampling data.

Math Source Waveforms (Source1, Source2, Source3, and Source4)

The options are the same as were described above for basic arithmetic. For details, see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

Sign

You can set the sign of the sampling data of the math source waveforms to positive or negative.

Coefficient (K)

Set scaling coefficient K. Range: -9.9999E+30 to +9.9999E+30. The default value is 1.0000.

Frequency (Frequency)

Calculates the frequency of the waveform that has been assigned to Source.

Math Source Waveform (Source)

The options are the same as were described above for basic arithmetic. However, you can select an input channel of a logic module (select the channel, and then select the bit). You cannot select an input channel of a frequency module. For details, see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

Slope (Slope), Level (Level), Hysteresis (Hysteresis)

Set the signal level,¹ the slope (rising or falling), and the hysteresis² of the edges that are used to detect the periods. If the math source is the signal of a logic module, only set the slope.

- 1 The signal level range is the same as the trigger level range. For details, see the *Features Guide*, IM DL850E-01EN.
- 2 The hysteresis level is the same as the trigger hysteresis. For details, see the *Features Guide*, IM DL850E-01EN.

Scaling (Scaling)

Select the unit that is used on the vertical scale.

- Hz: The unit is hertz.
- Rpm: The unit is revolutions per minute.

Pulses per Rotation (Pulse/Rotate)

If scaling is set to Rpm, set the number of pulses per rotation. Selectable range: 1 to 99999. The default setting is 1.

Deceleration Prediction (Deceleration Prediction)

Set whether to compute the decelaration curve from the elapsed time after the pulse input stops.

- ON: Deceleration prediction is performed.
- OFF: Deceleration prediction is not performed. For details, see the *Features Guide*, IM DL850E-01EN.

Stop Prediction (Stop Prediction)

Set the time from the point when the pulse input stops to the point when the DL850E/DL850EV determines that the object has stopped.

- 2, 4, 8, 16: Stop prediction is performed on the basis of the specified number of times the pulse period (T) of the pulse one period before the pulse input stopped.
- OFF: Stop prediction is not performed. For details, see the features guide, IM DL850E-01EN.

Offset (Hz/Rpm) (Offset (Hz/Rpm))

Offset can be added to display only the changes in the frequency at a higher resolution. Selectable range: -9.9999E+30 to +9.9999E+30.The default value is 0.0000

Period (Period)

Calculates the period of the waveform that has been assigned to Source.

Math Source Waveform (Source)

The options are the same as were described above for basic arithmetic. However, you can select an input channel of a logic module (select the channel, and then select the bit). You cannot select an input channel of a frequency module. For details, see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

Slope (Slope), Level (Level), Hysteresis (Hysteresis), Deceleration Prediction (Deceleration Prediction), Stop Prediction (Stop Prediction)

Set the slope (rising or falling), signal level, and hysteresis of the edges that are used to detect the periods as well as the deceleration prediction and stop prediction. These settings are shared with the Frequency operation.

Edge Count (Edge Count)

Counts the number of slope edges of the waveform that has been assigned to Source. You can use this to count the number of events in consecutive tests.

Math Source Waveform (Source)

The options are the same as were described above for basic arithmetic. However, you can select the input channel of a logic module (select the bit after selecting the channel) or select the S&C and Error Trigger sub channels of a SENT module. You cannot select an input channel of a frequency module. For details, see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

Slope (Slope), Level (Level), Hysteresis (Hysteresis)

Set the slope (rising or falling), the signal level, and the hysteresis of the edges that you want to count. These settings are shared with the Frequency operation.

Reset Condition (Reset Condition)

Select the condition for resetting the count from one of the settings below.

- Start (Start): When the waveform acquisition starts
- Overlimit (Overlimit): When "Value/Div" exceeds +10 div or falls below -10 div

Manual Reset (Manual Reset)

To manually reset the count, select Execute.

Resolver (Resolver)

Calculates the angle of rotation from the sine signal and cosine signal that are generated from the detection coils of the resolver depending on the angle of the rotor.

Sine Phase Signal and Cosine Phase Signal (Sin Ch, Cos Ch)

Select the sine signal and the cosine signal that are generated from the detection coil of the resolver. The options are the same as were described above for basic arithmetic. For details, see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

Excitation Signal (Carrier Ch)

Select the resolver's excitation signal. The options are the same as were described above for basic arithmetic. For details, see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

Hysteresis (Hysteresis)

Set the rising edge hysteresis of the excitation, sine, and cosine signals. When the sample point mode in detail settings is set to Auto, this setting is applied to all signals. When the sample point mode is set to Manual, this setting is applied to the excitation signal.

Tracking Filter (Tracking Filter)

If the sine signal and cosine signal data is changing in a staircase pattern, select a filter that will smooth out the data that is used to calculate the angle of rotation. OFF, 2kHz, 1kHz, 250Hz, 100Hz

Detail Setting (Detail)

Sample Point (Sample Point)

• Mode (Mode)

To enable more accurate calculations of the angle of rotation, set the mode that is used to sample the peak values of sine and cosine signals.

- Auto: The rising edges of the excitation, sine, and cosine signals are detected, and the peak values of sine signals and cosine signals are sampled automatically.
 - The Auto setting can be applied when the time difference of the sine and cosine signals in reference to the excitation signal is less than ±90°(π/2).
 - Turn the SCALE knob to set the vertical scale (V/div) so that the amplitudes of the excitation, sine, and cosine signals are all ±1.5 div or greater. If the amplitudes are less than ±1.5 div, the Auto function will not operate.
- Manual: The rising edge of the excitation signal is detected, and sine and cosine signals at the specified time (Time) after this detected rising edge are sampled. Time Setting

Selectable range: 0.1 µs to 1000.0 µs, Default value: 0.1 µs, Resolution: 0.1 µs.

Scaling (Scaling)

Select how the upper and lower limits of the vertical scale are displayed. -180° to $+180^{\circ}$, 0° to 360° , $-\pi$ to $+\pi$, 0 to 2π

Offset (°) (Offset (°))

An offset can be added to set the initial phase of the rotation angle. Selectable range: -180.00° to +180.00°. The default setting is 0.00°, and the resolution is 0.01°.

Note.

- To improve the calculation accuracy, set the vertical axis sensitivity for each signal so that the signal amplitude is as large as possible.
- Set the vertical axis sensitivity to the same value for sine signals and cosine signals. If you specify
 different values, the DL850E/DL850EV cannot perform calculations correctly.

IIR Filter (IIR Filter)

This can be used to filter the waveform that has been set to Source with the same characteristics of the IIR filter of the digital filter. You can set the frequency to values over a wider range than is available with the IIR filter of the digital filter.

Math Source Waveforms (Source)

The options are the same as were described above for basic arithmetic. For details, see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

Filter Band (Filter Band)

Select the filter band. Low-Pass, High-Pass, Band-Pass

Cutoff Frequency (CutOff)

When the filter band is set to Low-Pass or High-Pass, set the cutoff frequency. The ranges and resolutions are indicated below.

Filter Band	Range	Resolution
Low-Pass	0.2 Hz to 3.00 MHz	0.2 Hz (range: 0.2 Hz to 29.8 Hz)
	Default value: 0.30 MHz	2 Hz (range: 30 Hz to 298 Hz)
		0.02 kHz (range: 0.30 kHz to 2.98 kHz)
		0.2 kHz (range: 3.0 kHz to 29.8 kHz)
		2 kHz (range: 30 kHz to 298 kHz)
		0.02 MHz (range: 0.30 MHz to 3.00 MHz)
High-Pass	0.02 kHz to 3.00 MHz	0.02 kHz (range: 0.02 kHz to 2.98 kHz)
	Default value: 0.30 MHz	0.2 kHz (range: 3.0 kHz to 29.8 kHz)
		2 kHz (range: 30 kHz to 298 kHz)
		0.02 MHz (range: 0.30 MHz to 3.00 MHz)

Center Frequency (Center Frequency)

When the filter band is set to Band-Pass, set the center frequency. The ranges and resolutions are indicated below.

Range	Resolution	
0.06 kHz to 3.00 MHz	0.02 kHz (range: 0.06 kHz to 1.18 kHz)	
Default value: 0.30kHz	0.2 kHz (range: 1.2 kHz to 11.8 kHz)	
	2 kHz (range: 12 kHz to 118 kHz)	
	0.02 MHz (range: 0.12 MHz to 3.00 MHz)	

Bandwidth (Pass Band)

When the filter band is set to Band-Pass, select the bandwidth. The bandwidth options vary depending on the center frequency that you have set. For details on the options, see the appendix.

Interpolation On and Off (Interpolate)

Select whether to perform data interpolation. Up to 10 M samples of data can be interpolated from the data of waveforms that pass through the real time math IIR filter. The interpolation method is linear interpolation.

- ON: Data is interpolated.
- OFF: Data is not interpolated.

Demodulation of the Pulse Width Modulated Signal (PWM)

Integrates a pulse width modulation signal and demodulates it to an analog signal.

Math Source Waveforms (Source)

The options are the same as were described above for basic arithmetic. For details, see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

Period of the Pulse Width Modulated Signal (Period)

Set the period of the pulse width modulated signal. The pulse width modulation signal is repeatedly integrated over the set period and demodulated to an analog signal.

Selectable range: 0.1 μs to 5000.0 $\mu s,$ Default value: 0.1 $\mu s,$ Resolution: 0.1 $\mu s.$

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Features

Reactive Power (Reactive Power(Q))

Calculates the reactive power from apparent power and effective power.

To calculate the reactive power, you must use the real time math feature to calculate the apparent power and effective power by following the procedure below.

Apparent Power Calculation

- 1. Calculate the RMS voltage and current (RMS) that are used to derive the reactive power.
- 2. Take the product of the RMS voltage and current (S1*S2) that were calculated in step 1. The result is the apparent power.

Effective Power Calculation

Calculate the effective power of the RMS voltage and current (Power) that are used to derive the reactive power.

Apparent Power (Apparent Power(S))

Select the real time math channel (RMath channel) used to calculate the apparent power.

Effective Power (Effective Power(P))

Select the real time math channel (RMath channel) used to calculate the effective power.

Reactive Power Polarity

Determine the reactive power polarity from the phases of the voltage and current used to derive the reactive power.

Voltage (Voltage)

Select the voltage channel used to derive the reactive power.

The options are the same as were described above for basic arithmetic. However, you cannot select input channels of frequency modules. For details,see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

Hysteresis (Hysteresis)

Select the hysteresis used to detect the zero crossing of the selected voltage. The hysteresis level is the same as the trigger hysteresis. For details, see the *Features Guide*, IM DL850E-01EN.

Current (Current)

Select the current channel used to derive the reactive power.

The options are the same as were described above for basic arithmetic. However, you cannot select input channels of frequency modules. For details, see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

CAN ID Detection (CAN ID)

Detect the frame of the CAN bus signal with the specified ID. A pulse waveform whose detection point is at high level is displayed.

Detection Source Waveforms (Source)

CH1 to CH16,¹ RMath1 to RMath²

- 1 You can select an input channel of an installed module. However, you cannot select an input channel of a logic, frequency, 16-CH voltage, 16-CH temperature/voltage, CAN bus monitor, CAN & LIN bus monitor, CAN/CAN FD monitor, or SENT monitor module.
- 2 You can use other RMath waveforms as math source waveforms. If you set the real time math channel to RMathX, you can select the RMath waveforms on channels up to RMathX–1. If the real time math channel is RMath1, you cannot use any other RMath waveforms as math source waveforms.

Bit Rate (Bit Rate)

Select the transmission speed of the CAN bus signal to detect. 10k, 20k, 33.3k, 50k, 62.5k, 66.7k, 83.3k, 100k, 125k, 200k, 250k, 400k, 500k, 800k, or 1Mbps

Message Format

Select the data frame message format of the CAN bus signal to detect. STD: Standard format XTD: Extended format

ID (Hexadecimal (Hex))

Set the data frame message ID of the CAN bus signal to detect. Standard format (11 bits): 0x000 to 0x7ff Extended format (29 bits): 0x00000000 to 0x1fffffff

Torque (Torque)

Measures frequency f of the waveform specified as the source and calculate the torque. A(f+c) f: Measuring frequency A and C: Coefficients

Math Source Waveforms (Source)

The options are the same as were described for basic arithmetic. However, you can select the input channels of logic modules (select the channel, and then select the bit).

You cannot select the input channel of a frequency module. For details, see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

Slope (Slope), Level (Level), Hysteresis (Hysteresis)

Set the signal level¹, the slope (rising or falling), and the hysteresis² of the edges that are used to detect the periods.

If the math source is the signal of a logic module, set only the slope.

- 1 The signal level range is the same as the trigger level range.
- 2 The hysteresis level is the same as the trigger hysteresis.

Deceleration Prediction (Deceleration Prediction)

Set whether to compute the deceleration curve from the elapsed time after the pulse input stops.

- ON: Deceleration prediction is performed.
- OFF: Deceleration prediction is not performed.

Stop Prediction (Stop Prediction)

Set the time from the point when the pulse input stops to the point when the DL850E/DL850EV determines that the object has stopped.

- 2, 4, 8, 16: Stop prediction is performed on the basis of the specified number of times the pulse period (four settings) of the pulse one period before the pulse input stopped.
- OFF: Stop prediction is not performed.

For details, see the Features Guide, IM DL850E-01EN.

Coefficients (A and C)

Set the scaling coefficient (A) and the frequency reference (C).

Angle Difference (S1–S2(Angle))

Determines the angle difference in the range of -180° to $+180^{\circ}$ by subtracting the Source2 angle from the Source1 angle.

If the computed value is in the range of -360° to -180° or $+180^{\circ}$ to $+360^{\circ}$, this function calculates its supplement.

Math Source Waveforms (Source1 and Source2)

Select the input channels to assign to Source1 and Source2 for calculating the angle difference. The options are the same as were described for basic arithmetic. However, you cannot select input channels of frequency modules. For details, see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

Scaling (Scaling)

Select the unit that is used on the vertical scale.

- · Radian: Radian
- Degree: Degrees

3 Phase Resolver (3 Phase Resolver)

Calculates the angle of rotation from the two sine signals that are generated from the detection coil of the 3 phase resolver depending on the angle of the rotor.

Sine Signal Phase (Phase)

Select the phases of the two sine signals that are generated from the detection coil of the 3 phase resolver.

 0° to $120^\circ,$ 0° to $240^\circ,$ 120° to 240

Sine Signal (Sin Ch)

In accordance with the phases selected in the previous section, select the sine signals that are generated from the detection coil of the 3 phase resolver. The options are the same as were described for basic arithmetic. For details, see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

Excitation Signal (Carrier Ch)

Select the 3 phase resolver's excitation signal. The options are the same as were described for basic arithmetic. For details, see "Notes Regarding Using the Digital Filter and Real Time Math" on page 1-41.

Hysteresis (Hysteresis)

Set the rising edge hysteresis of the excitation, and sine signals. When the sample point mode in detail settings is set to Auto, this setting is applied to all signals. When the sample point mode is set to Manual, this setting is applied to the excitation signal.

Tracking Filter (Tracking Filter)

If the sine signal and cosine signal data is changing in a staircase pattern, select the cutoff frequency of the tracking filter that will smooth out the data that is used to calculate the angle of rotation.

OFF, 2kHz, 1kHz, 250Hz, 100Hz

Detail Setting (Detail

Sample Point (Sample Point)

• Mode (Mode)

To enable more accurate calculations of the angle of rotation, set the mode that is used to sample the peak values of sine signals.

- Auto: The rising edges of the excitation and sine signals are detected, and the peak values of sine signals are sampled automatically.
 - The Auto setting can be applied when the time difference of the sine signals in reference to the excitation signal is less than $\pm 90^{\circ}$ ($\pi/2$).
 - Turn the SCALE knob to set the vertical scale (V/div) so that the amplitudes of the excitation, and sine signals are all ± 1.5 div or greater. If the amplitudes are less than ± 1.5 div, the Auto function will not operate.
- Manual: The rising edge of the excitation signal is detected, and sine signals at the specified time (Time) after this detected rising edge are sampled. Time Setting

Selectable range: 0.1 µs to 1000.0 µs. The default setting is 0.1 µs, and the resolution is 0.1 µs.

Scaling (Scaling)

Select how the upper and lower limits of the vertical scale are displayed. -180° to $+180^{\circ}$, 0° to 360° , $-\pi$ to $+\pi$, 0 to 2π

Offset (°) (Offset(°))

An offset can be added to set the initial phase of the rotation angle. Selectable range: -180.00° to $+180.00^{\circ}$. The default setting is 0.00° , and the resolution is 0.01° .

Note_

- To improve the calculation accuracy, set the vertical axis sensitivity for each signal so that the signal amplitude is as large as possible.
- Set the vertical axis sensitivity to the same value for sine signals and cosine signals. If you specify
 different values, the DL850E/DL850EV cannot perform calculations correctly.

Power Math (ANALYSIS)

Digital Monitor Mode (Digital Monitor Mode)

Only the numeric monitor of the selected group is displayed on the screen.

Display Group: Only the numeric monitor of the group selected with Select Display Gr of Display Groups (DISPLAY) is displayed on the screen.

Power: Only the numeric monitor of the power analysis measurement functions is displayed on the screen.

Harmonic: Only the numeric monitor of the harmonic analysis measurement functions is displayed on the screen.

Power Analysis (Power)

The voltage and current measured on separate input channels can be used as math sources to calculate various power parameters for power analysis. This is a feature available on the /G5 option.

• Power analysis can be performed when any of the following modules is installed in a slot other than slot 7.

701250 (HS10M12), 720250(HS10M12), 701251 (HS1M16), 701255 (NONISO_10M12), 701267 (HV (with RMS)), 720268(HV(AAF, RMS)), 720210 (HS100M12), 720211 (HS100M12), 701261 (UNIVERSAL), 701262 (UNIVERSAL (AAF)), 701265 (TEMP/HPV), 720266(TEMP/HPV), 701275 (ACCL/VOLT), 720254 (4CH 1M16)

- Channels that can be used for power analysis are CH13 and CH14. Power analysis results are output to the subchannels of CH13 and CH14.
 The number of calculations performed in one analysis is equal to the total number of subchannels of CH13 and CH14.
- There can be up to 126 power analysis parameters that can be calculated. The number of parameters varies depending on the number of systems to be analyzed and wiring system. For details, see the appendix.
- Power analysis conditions can be changed even during waveform acquisition. However, if you change the conditions, the measurement count (waveform acquisition count) is reset. The measurement count is displayed in the lower left of the screen.
- The analysis result waveform can be used as a trigger source, but it cannot be used as a real time math source.
- Power analysis can be performed on two systems. This allows power efficiency and motor efficiency to be calculated.

Measurement Functions

The various physical quantities such as rms voltage, average current, power, and phase difference that the DL850E/DL850EV measures and displays are called measurement functions. Each physical quantity is displayed with a corresponding symbol. For example, Urms represents the true rms voltage.

Source Channels

The channels that receive the pair of voltage and current signals to be measured are called source channels.

There are three source channel numbers: 1, 2, and 3. The DL850E/DL850EV displays a source channel number after the measurement function symbol to indicate which source channel corresponds to the displayed numeric data.

For example, Urms1 represents the true rms voltage of source channel 1.

The channels that can be used as source channels are those of the modules that can perform power analysis (indicated above).

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Features

Wiring Unit

Wiring Unit refers to a group of two or three input source channels with the same wiring system used to measure three-phase power.

Wiring unit is represented with the symbol Σ . Measurement functions for wiring units are called Σ functions.

For example, Urms Σ represents the true rms value of the average of the voltages measured on the input source channels assigned to wiring unit Σ .

Configuration Example of Wiring System and Wiring Unit



Delta Math

Measurement function ΔU and ΔI can be determined based on the sum and difference of the instantaneous voltage and current (sampling data) of the source channels assigned to the wiring unit set as the delta math source. This calculation is called delta math.

$3P4W \rightarrow 3V3A$

• Using the data of a three-phase four-wire system, delta connection data can be calculated from star connection data (star-delta transformation).



3V3A→3P4W

• Using the data of a three-phase three-wire system (three-voltage, three-current method), star connection data can be calculated from delta connection data (delta-star transformation). This is useful when you want to observe the phase voltage of a measurement source without a neutral line.



Measurement Function Types

Source channel measurement functions

The following 32 measurement functions are available.

- U (voltage): Urms (rms value),* Umn (rectified mean value calibrated to the rms value),* Udc (simple average), Uac (AC component)
- I (current): Irms (rms value),* Imn (rectified mean value calibrated to the rms value),* Idc (simple average), Iac (AC component)

P (active power), S (apparent power), Q (reactive power), λ (power factor), ϕ (phase difference), fU (voltage frequency), fI (current frequency), U+pk (maximum voltage), U-pk (minimum voltage), I+pk (maximum current), I-pk (minimum current), P+pk (maximum power), P-pk (minimum power), WP (integrated power), WP+ (positive integrated power), WP- (negative integrated power) q (integrated ampere-hour), q+ (positive integrated ampere-hour), q- (negative integrated ampere-hour), WS (volt-ampere hours), WQ (var hours),

Z (impedance), RS (series resistance), XS (series reactance), RP (parallel resistance), XP (parallel reactance)

* You can select either the rms value or the rectified mean value calibrated to the rms value (but not both). In either case, the value is displayed as rms.

Wiring unit Σ measurement functions

The following 24 measurement functions are available.

UΣ (average voltage): UrmsΣ (rms value),* UmnΣ (rectified mean value calibrated to the rms value),* UdcΣ (simple average), UacΣ (AC component)

$$\label{eq:starsest} \begin{split} & \text{I}\Sigma \text{ (average current): Irms}\Sigma \text{ (rms value),* Imn}\Sigma \text{ (rectified mean value calibrated to the rms value),*} \\ & \text{Idc}\Sigma \text{ (simple average), Iac}\Sigma \text{ (AC component)} \end{split}$$

 $P\Sigma$ (total active power), $S\Sigma$ (total apparent power), $Q\Sigma$ (total reactive power), $\lambda\Sigma$ (average power factor), $\phi\Sigma$ (average phase difference)

WP Σ (total integrated power), WP+ Σ (total positive integrated power), WP- Σ (total negative integrated power),

q Σ (total integrated ampere-hour), q+ Σ (positive total integrated ampere-hour), q- Σ (negative total integrated ampere-hour),

WS Σ (total apparent energy), WQ Σ (total reactive energy), Z Σ (average impedance), RS Σ (average series resistance), XS Σ (average series reactance), RP Σ (average parallel resistance), XP Σ (average parallel reactance)

* You can select either the rms value or the rectified mean value calibrated to the rms value (but not both). In either case, the value is displayed as rms.

Delta math measurement functions

For details on line voltages and R, S, and T points, see the wiring system figure provided later.

$\textbf{3P3W}{\rightarrow}\textbf{3V3A}$

The following 8 measurement functions are available. Urs (R-S line voltage): Urms3 (rms value),* Umn3 (rectified mean value calibrated to the rms value),* Udc3 (simple average), Uac3 (AC component)

It (phase current): Irms3 (rms value),* Imn3 (rectified mean value calibrated to the rms value),* Idc3 (simple average), Iac3 (AC component) 1

Features

$3V3A \rightarrow 3P4W$

The following 13 measurement functions are available.

Ur (R-N voltage): Urms1 (rms value),* Umn1 (rectified mean value calibrated to the rms value),* Udc1 (simple average), Uac1 (AC component)

Us (S-N voltage): Urms2 (rms value),* Umn2 (rectified mean value calibrated to the rms value),* Udc2 (simple average), Uac2 (AC component)

Ut (T-N line voltage): Urms3 (rms value),* Umn3 (rectified mean value calibrated to the rms value),* Udc3 (simple average), Uac3 (AC component)

In (neutral line current)

3P4W→3V3A

The following 13 measurement functions are available.

Urs (R-S voltage): Urms1 (rms value),* Umn1 (rectified mean value calibrated to the rms value),* Udc1 (simple average), Uac1 (AC component)

Ust (S-T voltage): Urms2 (rms value),* Umn2 (rectified mean value calibrated to the rms value),* Udc2 (simple average), Uac2 (AC component)

Utr (T-R line voltage): Urms3 (rms value),* Umn3 (rectified mean value calibrated to the rms value),* Udc3 (simple average), Uac3 (AC component)

In (neutral line current)

* You can select either the rms value or the rectified mean value calibrated to the rms value (but not both). In either case, the value is displayed as rms.

Other measurement functions

The following 3 measurement functions are available. η (efficiency): Motor efficiency, power efficiency Uubf (three-phase voltage unbalance factor) Iubf (three-phase current unbalance factor)

Analysis Mode (Analysis Mode)

Select the system to be analyzed.

- 1 Wiring System: One system is analyzed.
- 2 Wiring Systems: Two systems are analyzed. The primary and secondary sides of the system to be analyzed can be measured to derive the efficiency.
- OFF: Power analysis is disabled.
- · Device's power factor example

Input power	Inverter or similar device	Output power
PΣ of Wiring System 1		PΣ of Wiring System 2

Setting Analysis Conditions (Wiring System)

Set the wiring system, math source waveforms, and analysis method (measurement period, analysis conditions, and efficiency).

Wiring System (Wiring)

The following eight wiring systems are available on the DL850E/DL850EV.

- 1P2W: Single-phase two-wire
- 1P3W: Single-phase three-wire
- 3P3W: Three-phase three-wire
- 3V3A: Three-voltage three-current measurement method
- 3P4W: Three-phase four-wire
- $3P3W \rightarrow 3V3A$: Conversion of three-phase three-wire system data to the three-voltage three-current measurement method
- 3V3A→3P4W: Delta-star transformation using three-phase three-wire system data
- 3P4W->3V3A: Star-delta transformation using three-phase four-wire system data

To apply voltage, use a passive probe.

For details on how to select the appropriate passive probes and how to connect them (high and low), see section 3.5 in the Getting Started Guide, IM DL850E-03EN.

To apply current, use a current probe.

For details on how to select the appropriate current probes and how to connect them (current direction), see section 3.5 in the Getting Started Guide, IM DL850E-03EN, and the user's manual that came with the current probe.

• Single-Phase Two-wire (1P2W)

Two channels that receive one pair of voltage and current signals can be wired.



• Single-Phase Three-Wire (1P3W)

Four channels that receive two pairs of voltage and current signals can be wired.



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• Three-Phase Three-Wire (3P3W)

Four channels that receive two pairs of voltage and current signals can be wired.



• Three-Voltage Three-Current Method (3V3A) Six channels that receive three pairs of voltage and current signals can be wired.



• Three-Phase Four-Wire (3P4W)

Six channels that receive three pairs of voltage and current signals can be wired.



• Conversion of Three-Phase Three-Wire System Data to the Three-Voltage Three-Current Measurement Method (3P3W→3V3A)

Four channels that receive two pairs of voltage and current signals can be wired. Urs and It can be determined using delta math.


• Delta-Star Transformation (3V3A→3P4W)

Six channels that receive three pairs of voltage and current signals can be wired. Ur, Us, Ut, and In can be determined using delta math.

The center of the delta connection is assumed to be the center of the star connection. If the actual centers are not aligned, errors will result in the calculation.



• Star-Delta Transformation (3P4W→3V3A)

Six channels that receive three pairs of voltage and current signals can be wired. Urs, Ust, Utr, and In can be determined using delta math.



Math Source Waveforms (U1 to U3, I1 to I3)

The modules described in "Power analysis can be performed only when one of the following modules is installed in a slot other than slot 7" under "Power Analysis (Power)" are applicable. CH13 or CH14 cannot be selected.

Calculation Period (Calc Period)

Select the method that is used to determine the calculation period of power math values.

- Edge: Power math starts when an edge is detected on the specified channel. The previous data is held until an edge is detected.
- Auto Timer: Calculation is performed at the specified interval, regardless of edge detection.
- AC: Power math starts when an edge is detected on the specified channel. Stop prediction can be specified. The power value is set to 0 after a stop detection. This is useful for analysis in which the power becomes 0 when the rotation of the motor or the like stops.
- AC+DC: After a stop is detected, the mode switches automatically to Auto Timer (calculation at a given interval). This is useful for analysis in which the DC component resides even after a stop.

If the Calculation Period Is Edge

- Edge Detection Source (Edge Source) Select the input channel of the signal that is used to determine the calculation period.
- Hysteresis (Hysteresis)

The same as the standard feature. For details, see "Trigger Hysteresis" the chapter 4 in the *Features Guide*, IM DL850E-01EN.

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• Edge Source Filter (Edge Source Filter)

Select from the following.

OFF, 128 kHz, 64 kHz, 32 kHz, 16 kHz, 8 kHz, 4 kHz, 2 kHz, 1 kHz, 500 Hz, 250 Hz, 125 Hz, 62.5 Hz

The DL850E/DL850EV reduces the effects of noise by using hysteresis when it detects zero crossings.

If the synchronization source is distorted or harmonics and noise are superposed on the signal to a level exceeding this hysteresis, harmonic components will cause zero crossing detection to occur frequently, and the zero crossing of the fundamental frequency will not be detected stably. Consequently, the measured voltage and current may be unstable. To stably detect zero crossings, set the edge source filter.

If the Calculation Period Is Auto Timer

Set the calculation period update time. Range: 100 ns to 500 ms. Resolution: 100 ns.

If the Calculation Period Is AC

- Edge Detection Source (Edge Source) The options are the same as Edge.
- Hysteresis (Hysteresis) and Edge Source Filter (Edge Source Filter) The options are the same as Edge.

Stop Prediction (Stop Prediction)

Set the time from the point when the pulse input stops to the point when the DL850E/DL850EV determines that the object has stopped.

2, 4, 8, 16: Stop prediction is performed on the basis of the specified number of times the pulse period (four settings) of the pulse one period before the pulse input stopped.
 For details, see chapter 2 in the *Features Guide*, IM DL850E-01EN.

If the Calculation Period Is AC+DC

- Edge Detection Source (Edge Source) The options are the same as Edge.
- Hysteresis (Hysteresis) and Edge Source Filter (Edge Source Filter) The options are the same as Edge.
- Stop Prediction (Stop Prediction) The options are the same as Edge.
- Update Time (Auto Timer)
 Range: 100 ns to 500 ms. Resolution: 100 ns.

Vertical Scale (Value/Div) Optimization (ALL Output Optimize Value/Div)

This is the same feature as Optimize Value/Div of real time math (RealTime Math).

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Features

Analysis Setting (Analysis Setting)

Set how to calculate power math values.

• RMS Type (RMS Type)

Select the rms value from the following. True RMS (rms value), Rect. Mean (rectified mean value calibrated to the rms value)

• φ Scaling (φ Scale)

Select how to display phase differences. Radian: Radian Degree: Degrees

Integration Condition (Condition)

All times: Integration is performed at all times. In Acquisition: Integration is performed only during measurement.

Reset on Start (Reset on Start)

OFF: Integration continues regardless of the START/STOP key state. To reset the value, reset manually.

ON: The integrated value is reset to zero whenever waveform acquisition starts as a result of pressing the START/STOP key.

When Integration Condition is set to All times

When Reset on Start is OFF



Integration at all times Integrated value reset at star

· When Reset on Start is ON

When Integration Condition is set to In Acquisition



aIntegration only during measurementIntegrated value reset at start

When Reset on Start is ON

Integrated Integrated value

START STOP START STOP START STOP

• Scaling (Scaling)

Select the integral time unit. Second: Second Hour: Hour

Efficiency Setting (Efficiency Setting)

Select the measurement function efficiency η type from the following.

• Power: The power efficiency is calculated. Available when the analysis mode is 2Wirig System.

- Motor: The motor drive efficiency is calculated.
- OFF: Efficiency is not calculated.

• Torque (Torque)

Select the real time math channel set to math "Torque."

• Coefficient (K)

Set scaling coefficient K. Range: -9.9999E+30 to +9.9999E+30. The default value is 1.0000.

• Pm Type (Pm Type)

Select the type of rotating speed. RotationAngle: Rotation angle (rad/s) Speed: Rotating speed

When the Pm Type Is RotationAngle

• Rotation Angle (Rotation Angle)

Select the real time math channel set to math "Rotary Angle."

When the Pm Type Is Speed

- **Speed** Select the input channel of the module measuring the number of rotations.
- Scaling (Scaling)

Select the unit that is used on the vertical scale. rps: The unit is set to revolutions per second. rpm: The unit is set to revolutions per minute.

Harmonic Analysis (Harmonics)

Harmonics refer to sine waves whose frequency is an integer multiple (2 and higher) of the fundamental wave except for the fundamental wave itself.

When the fundamental is mixed with harmonics, waveform distortion results.

The DL850E/DL850EV analyzes the harmonics of rms values (voltage and current) and active power. The DL850E/DL850EV analyzes harmonic orders 1 to 40 for rms values and 1 to 35 for active power. This is a feature available on the /G5 option.

• Harmonic analysis can be performed when any of the following modules is installed in a slot other than slot 8.

701250 (HS10M12), 720250(HS10M12), 701251 (HS1M16), 701255 (NONISO_10M12), 701267 (HV (with RMS)), 720268(HV(AAF, RMS)), 720210 (HS100M12), 720211 (HS100M12), 701261 (UNIVERSAL), 701262 (UNIVERSAL (AAF)), 701265 (TEMP/HPV), 720266(TEMP/HPV), 701275 (ACCL/VOLT), 720254 (4CH 1M16)

- Channels that can be used for harmonic analysis are CH15 and CH16. Harmonic analysis results are output to the subchannels of CH15 and CH16.
 The number of calculations performed in one analysis is equal to the total number of subchannels of CH15 and CH16.
- The maximum number of harmonic analysis parameters that can be calculated is as follows. Harmonic analysis of rms values: 123 parameters Harmonic analysis of active power: 121 parameters
- The harmonic analysis result waveform can be used as a trigger source, but it cannot be used as a real time math source.

Measurement Functions and Source Channels

For the terminology definitions, see "Measurement Functions" and "Source Channels" provided in the Power Analysis section.

Measurement Function Types

The following measurement functions are available.

Rms Value Measurement Functions

RMS (rms values of the 1st to the 40th harmonic), Rhdf (percentage contents of the 1st to the 40th harmonic), ϕ (phases of the 1st to the 40th harmonic), RMS (total rms value), THDIEC (distortion factor: IEC), THDCSA (distortion factor: CSA)

Active Power Measurement Functions

P (active powers of the 1st to the 35th harmonic), Phdf (active power percentage contents of the 1st to the 35th harmonic), ϕ (active power phases of the 1st to the 35th harmonic), P (all active powers), S (all apparent powers), Q (all reactive powers), λ (power factor),

U1 (1st harmonic rms voltage), U2 (1st harmonic rms voltage), U3 (1st harmonic rms voltage), I1 (1st harmonic rms current),

I2 (1st harmonic rms current), I3 (1st harmonic rms current), φ U1-U1 (phase angle), φ U1-I1 (phase angle), φ U1-U2 (phase angle), φ U1-I2 (phase angle), φ U1-U3 (phase angle), φ U1-I3 (phase angle) angle)

Analysis Mode (Analysis Mode)

Select the harmonic analysis item.

- Line RMS: Harmonic analysis is performed on voltage and current.
- Power: Harmonic analysis is performed on active power.
- OFF: Harmonic analysis is disabled.

1

Features

When the Analysis Mode Is Line RMS

Math Source Waveforms (Source)

The modules described in "Harmonic analysis can be performed only when one of the following modules is installed in a slot other than slot 8" under "Harmonic Analysis (Harmonic)" are applicable. CH15 or CH16 cannot be selected.

• Edge Detection Source (Edge Source)

The same channel as the math source waveform (cannot be changed).

• Hysteresis (Hysteresis)

The same as the standard feature. For details, see "Trigger Hysteresis" in chapter 4.

Edge Source Filter (Edge Source Filter)

Select from the following. OFF, 128 kHz, 64 kHz, 32 kHz, 16 kHz, 8 kHz, 4 kHz, 2 kHz, 1 kHz, 500 Hz, 250 Hz, 125 Hz, 62.5 Hz This is the same as "Edge Source Filter" described under "Power Analysis (Power)."

• φ Scaling (φ Scale)

Select how to display phase differences. Radian: Radian Degree: Degrees

When the Analysis Mode is Power

Wiring System (Wiring)

The same as Wiring System under "Power Analysis (Power)."

Math Source Waveforms (U1 to U3, I1 to I3)

The options are the same as those for Line RMS analysis mode.

Edge Detection Source (Edge Source)

The same channel as the math source waveform. Select from U1 to U3 and I1 to I3.

• Hysteresis (Hysteresis)

The same as the standard feature. For details, see "Trigger Hysteresis" in chapter 4.

Edge Source Filter (Edge Source Filter)

Select from the following. OFF, 128 kHz, 64 kHz, 32 kHz, 16 kHz, 8 kHz, 4 kHz, 2 kHz, 1 kHz, 500 Hz, 250 Hz, 125 Hz, 62.5 Hz

This is the same as "Edge Source Filter" described under "Power Analysis (Power)."

φ Scaling (φ Scale)

Select how to display phase differences. Radian: Radian Degree: Degrees

All Item (Value/Div) Optimization (ALL Output Optimize Value/Div)

This is the same feature as Optimize Value/Div of real time math (RealTime Math).

Harmonic Analysis Window Setup (Harmonic Window Setup)

Graph Position (Graph Position)

Select the analysis position on the waveform display of the main screen. The analysis results for the cursor position are displayed in the graph window.

Main Screen Ratio (Main Ratio)

Set the percentage of the entire waveform display area that the main screen will occupy.

- 50%: The main screen is displayed in the top half of the entire area.
- 20%: The main screen is displayed in the top 20% of the entire area.
- 0%: The main screen is not displayed.

Window Layout (Window Layout)

Set the display layout of the two graph windows.

- · Side: Side by side
- Vertical: Top and bottom

Graph Window (Graph Window)

Select from the following.

- Bar: A bar graph is displayed for the calculated harmonic value of each harmonic up to the 40th harmonic.
- Vector: The relationship of the phase difference and size (rms value) between the fundamental waves U(1) and I(1) of the source channel is displayed with vectors.
- List: A numerical list is displayed for the calculated harmonic value of each harmonic up to the 40th harmonic.

When the Graph Window is Bar

• Display Item (Display Item)

The following parameters can be displayed. RMS (rms value), P (active power), hdf (percentage content), ϕ (phase)

• Maximum Order to Display (Display Max Order)

Set the harmonics to display in the graph window. The range is as follows. Line RMS mode: 1 to 40 Power mode: 1 to 35

• Vertical Scale (V Scale)

Set the vertical scale to Linear or Log (logarithmic). This setting applies to the scales for RMS (rms value) and P (active power).

Graph display example



1

When the Graph Window is Vector

• Numeric Display On/Off

Set whether to display the numeric measured results in the graph window. ON: The numeric measured results are displayed. OFF: The numeric measured results are not displayed.

Zoom (U:Zoom, I:Zoom)

You can change the size of vectors. When you zoom the vectors, the value that indicates the size of the vector display's peripheral circle changes according to the zoom factor. Range: 0.1 to 100



When the wiring system is 1P2W (single-phase two-wire), 1P3W (single-phase three-wire), 3P3W (three-phase four-wire), 3P4W (three-phase four-wire), or 3V3A→3P4W (delta-star transformation) • U1(1), U2(1), and U3(1) are phase voltages.

• I1(1), I2(1), and I3(1) are line currents.



When the Graph Window is List

- Display Item (Display Item) The same as with Bar.
- Maximum Order to Display (Display Max Order) The same as with Bar.

• List Start Order (List Start Order)

Set the harmonic to display at the top of the list. Harmonics less than the specified harmonic are not shown in the list. This is used to scroll the list. The range is as follows. Line RMS mode: 1 to 40 Power mode: 1 to 35

List display example (rms and percentage content)



Press the List Start Order soft key and turn the jog shuttle

Harmonics Harmonic analysis values

Labels (Label)

This is the same as the feature on the standard model. For details, see the *Features Guide*, IM DL850E-01EN.

Optimizing Value/Div (Optimize Value/Div)

Press the Optimize Value/Div soft key to automatically set the value/div that the DL850E/DL850EV determines is the most appropriate for the math source waveform range and the expression. The selected value is from among the 123 value/div options for vertical axis sensitivity.

- The automatically selected option does not line up with the input values and math results, so you need to use the SCALE knob to change the value/div.
- There are a total of 123 value/div options within the following range: 500.0E+18 to 10.00E-21 (in steps of 1, 2, or 5).

Waveform Vertical Position (Vertical POSITION knob)

This is the same as the feature on the standard model. For details, see the *Features Guide*, IM DL850E-01EN.

Zoom Method (V Scale), Zooming by Setting a Magnification (V Zoom), Zooming by Setting Upper and Lower Display Limits (Upper/Lower)

This is the same as the feature on the standard model. For details, see the *Features Guide*, IM DL850E-01EN.

Offset (Offset)

This is the same as the feature on the standard model. For details, see the *Features Guide*, IM DL850E-01EN.

Trace Settings (Trace Setup)

This is the same as the feature on the standard model. For details, see the *Features Guide*, IM DL850E-01EN.

Notes Regarding Using the Digital Filter and Real Time Math Real Time Math Source Modules and Channels

The modules and channels that you can select as real time math source waveforms (source) are shown below.

		Input Modu	le Model a	nd RMath (RMath (Real Time Math Channel)			
Op Fu	erators and nctions	701250, 720250, 701251, 701255, 701267, 720268, 701261, 701262, 701265, 720266, 701270, 701271, 701275, 720210, 720211, 720220, ¹ 720220, ¹ 720221, ¹ 720224	701281 720281	720230	720240, ^{1, 2} 720241, ^{1, 2} 720242, ^{1, 2} 720243, ^{1, 2} (Only usable on the DL850EV)	RMath ³		
S1+S S1*S	52, S1 – S2, 52, S1/S2	Yes	Yes	No	Yes	Yes		
A(S1) A(S1) A(S1) A(S1)	+B(S2)+C, -B(S2)+C,)*B(S2)+C,)/B(S2)+C	Yes	Yes	No	Yes	Yes		
D Integ1(S	iff(S1), 1), Integ2(S1)	Yes	Yes	No	Yes	Yes		
Rota	ary Angle	Yes ⁴	No	Yes ⁴	Yes	No		
	DA	No	No	Yes	No	No		
Pol	ynomial	Yes	Yes	No	Yes	Yes		
RMS,	Math source	Yes	No	No	Yes	Yes		
Power	Edge source	Yes	No	Yes	Yes*2	Yes		
Pov	ver Integ	Yes	No	No	Yes	Yes		
Log	J1, Log2	Yes	Yes	No	Yes	Yes		
Sqr	t1, Sqrt2	Yes	Yes	No	Yes	Yes		
C	os, Sin	Yes⁴	No	Yes⁴	Yes	No		
	Atan	Yes	Yes	No	Yes	Yes		
Electrical	Math source	NO	NO	Yes	NO	NO		
Knc (Only se DL	ck Filter ettable on the 850EV)	Yes	No	No	Yes	No		
Poly	-Add-Sub	Yes	Yes	No	Yes	Yes		
Fre F	quency, Period	Yes	No	Yes	Yes	Yes		
Edg	je Count	Yes	No	Yes	Yes ²	Yes		
R	esolver	Yes	Yes	No	Yes	Yes		
IIF	R Filter	Yes	Yes	No	Yes	Yes		
	PWM	Yes	Yes	No	Yes	Yes		
Reactiv	/e Power(Q)	Yes	No	No	Yes ²	Yes		
C	AN ID	Yes ⁵	NO	Yes	Yes	Yes		
T	orque	Yes ⁵	NO	Yes	Yes	Yes		
2 Dhar	>2 (Angle)	Yes	N0 Vcc	N0	Yes	Yes		
5 Phas		IES	i ies		ies	IES		

For the names of the input modules, see the *Getting Started Guide*, IM DL850E-03EN.

- 1 To set the input channels of a 720220 16-CH voltage input module or a 720221 temperature/ voltage input module as the source waveforms of real time math, you have to set the input coupling (Coupling) to DC or GND. To set the input channels of a 720240 CAN bus monitor module, 720241 CAN & LIN bus monitor module, 720242 CAN/CAN FD monitor or 720243 SENT monitor module as the source waveforms of real time math, you have to turn the input (Input) on.
- 2 Input channels of a 720240 CAN bus monitor, 720241 CAN & LIN bus monitor or 720242 CAN/ CAN FD monitor module cannot be selected if the data type (Value Type) is set to Logic. Even if the data type is not set to Logic, you cannot use data that exceeds 16 bits in length. On a 720243 SENT monitor module, S&C and Error Trigger sub channels cannot be selected. However, if the function is Edge Count, these channels can be selected.
- 3 If you set the real time math channel to RMathX, you can select the RMath waveforms on channels up to RMathX–1. If the real time math channel is RMath1, you cannot use any other RMath waveforms as math source waveforms.
- 4 If you have turned logic sources on, select an input channel of a 720230 logic module. If logic sources have been turned off, select an input channel of an analog waveform module.
- 5 The input channels of a 16-CH voltage input module (720220) or 16-CH temperature/voltage input module (720221) cannot be selected.

Math Delay

The real time math delay is "1.4 µs + the digital filter delay + the math delay."

The digital filter and math delays vary depending on the type of filter and math operation.

- If you are using the result of a real time math channel as the source waveform for another real time math operation, the math delays accumulate.
- · For details, see the appendix.

Internal Processing of Real Time Math

The math source waveforms are 16-bit binary data. If they are only 12 bits long, they are converted to 16 bits. Internally, the waveforms are converted to floating-point numbers and calculated.

- The math results are converted to 16-bit data in relation to the range (value/div) and are then recorded in acquisition memory.
- The basic display is 2400 LSB/div (the same as the 16-bit analog waveform module).
- For details on the internal math expressions, see the appendix.

Differences between Real Time Math and Standard Math

This section explains the differences between the real time math operations that you configure by pressing CH (/G3 option) and the standard math operations that you configure by pressing MATH.

Real Time Math

- Math operations can be performed in real time on waveforms (A/D converted data) that are applied to the input channels of each of the modules.
- Even when the display is in roll mode, you can view the real time math results.
- There are no limits on the record length. Because the data of normal input channels is switched with the real time math results and acquired in acquisition memory, you can specify the same record length as that of the normal input channels.
- You can trigger the DL850E/DL850EV on real time math results.
- Regardless of the DL850E/DL850EV sample rate, math operations are always performed on the data that is output from each module at a maximum math rate of 10 MS/s.
- · Real time math can be used in all acquisition modes (including the dual capture mode).



Standard Math

- Because waveforms are processed after they are acquired, the waveform update period is long.
- Math cannot be performed when the display is in roll mode.
- Math is performed on data that was acquired into acquisition memory at the DL850E/DL850EV sample rate.
- Because math results are stored in the main memory of the main CPU, there are limits on the record length (for one channel, the maximum is 1 Mpoint).
- You can not trigger the DL850E/DL850EV on math results.
- Because math is performed by a general-purpose CPU, a wide variety of expressions are available.



1

2

Configuring Digital Filter Settings

Digital Filter

The digital filter operation menu has the following settings:

- Filter type: You can select from four filter types—Gauss, Sharp, IIR, and Mean.
- Filter band: You can select the type of filter bands.
- Delay: You can add a delay to the updating of data after data passes through a digital filter. For details on the digital filter, see chapter 1.

For the filter characteristics, see the appendix.

Gauss

This section explains the following settings (which are used when using the Gauss filter):

- Filter type
- Interpolation
- Filter band
- Delay
- Cutoff frequency

CH Menu

- 1. Press a key from CH1 to CH16, and then the RealTime Math soft key to select OFF.
- 2. Press the **Filter/Delay Setup** soft key and then the **Bandwidth** soft key to select Digital. The following menu appears.

		When you have selected the input channel of a frequency module
Filter/Delay Setup]	Filter/Delay Setup
Bandwidth	- Select Digital	Digital Filter
LPF Digital	Geleet Digital.	
Filter Type	- Salact Gauss	Filter Type
Gauss	Select Gauss.	
Filter Band	- Sat the filter hand (Law Dage)	
Low-Pass	Set the litter band (Low-Pass)	
😡 CutOff	Sat the suitoff fragmanay (usin	
30 <mark>0kHz</mark>	- Set the cuton frequency (usin	g the jog shuttle).
Interpolate	Turne internelation on and off	
OFF ON	- Turns interpolation on and on	
Delay		
0.0us	Set the delay (using the jog sl	nuttle).

Note.

- The same delay is used for all filter types of the same channel.
- To display the Filter/Delay Setup soft key on the setup menu that is displayed when you press a key from CH1 to CH16, press the RealTime Math soft key to select OFF.
- If you want to perform real time math at the same time as the digital filter, press the RealTime Math soft key again to select ON.
- For information on other features, how to use these features, and handling precautions, see the following manuals.
 - The Features Guide, IM DL850E-01EN
 - The User's Manual, IM DL850E-02EN
- The Getting Started Guide, IM DL850E-03EN

2 Configuring Digital Filter Settings

Sharp

This section explains the following settings (which are used when using the Sharp filter):

- Filter type
- Filter band
- Cutoff frequency
- Center frequency
- Bandwidth
- Interpolation
- · Delay

CH Menu

- 1. Press a key from CH1 to CH16, and then the RealTime Math soft key to select OFF.
- 2. Press the **Filter/Delay Setup** soft key and then the **Bandwidth** soft key to select Digital. The following menu appears.

	channel of a frequency mo	dule	
Filter/Delay Setup	Filter/Delay Setup		
Bandwidth	Digital Filter		
LPF Digital		N.	
Filter Type	Filter Type	When Filter Band	ls Set
Sharp	- Select Sharp.	to Band-Pass	
Filter Band		Filter Band	
Low-Pass	 Set the filter band (Low-Pass, High-Pass, Band-Pass). 	Band-Pass	
🗟 CutOff	Set the cutoff frequency	Center S	et the center frequency
30 <mark>0kHz</mark>	(using the jog shuttle).		ising the jog shuttle).
		Pass Band	
			et the bandwidth Ising the jog shuttle).
Interpolate	Turns interpolation on and off	Interpolate	
OFF ON			
Delay	Catthe datas	Delay	
0.0us	est the delay (using the jog shuttle).	0.0us	

When you have selected the input

Note_

- The same delay is used for all filter types of the same channel.
- To display the Filter/Delay Setup soft key on the setup menu that is displayed when you press a key from CH1 to CH16, press the RealTime Math soft key to select OFF.
- If you want to perform real time math at the same time as the digital filter, press the RealTime Math soft key again to select ON.
- For information on other features, how to use these features, and handling precautions, see the following manuals.
 - The Features Guide, IM DL850E-01EN
 - The User's Manual, IM DL850E-02EN
 - The Getting Started Guide, IM DL850E-03EN

This section explains the following settings (which are used when using the IIR filter):

- · Filter type
- · Filter band
- Cutoff frequency
- Center frequency
- Bandwidth
- Interpolation
- Delay

CH Menu

- 1. Press a key from CH1 to CH16, and then the RealTime Math soft key to select OFF.
- 2. Press the **Filter/Delay Setup** soft key and then the **Bandwidth** soft key to select Digital. The following menu appears.

	When you have select channel of a frequency	ed the input y module
Filter/Delay Setup	Filter/Delay Setup))	-
Bandwidth	Select Digital.	ct ON.
LPF Digital	OFF ON	
Filter Type	Filter Type	When Filter Band Is Set to Band-Pass
IR		
Filter Band	- Set the filter band	Filter Band
Low-Pass	(Low-Pass, High-Pass, Band-Pass).	Band-Pass
CutOff	- Set the cutoff frequency	Center Frequency Set the center frequency
	(using the jog shuttle).	300 Hz (using the jog shuttle).
		Pass Band Set the bandwidth
		200kHz (using the jog shuttle).
Interpolate	Turns interpolation on and off	Interpolate
OFF ON	•	OFF ON
Delay	- Set the delay	Delay
0.0us	(using the jog shuttle).	0.0us

Note.

- The same delay is used for all filter types of the same channel.
- To display the Filter/Delay Setup soft key on the setup menu that is displayed when you press a key from CH1 to CH16, press the RealTime Math soft key to select OFF.
- If you want to perform real time math at the same time as the digital filter, press the RealTime Math soft key again to select ON.
- For information on other features, how to use these features, and handling precautions, see the following manuals.
 - The Features Guide, IM DL850E-01EN
 - The User's Manual, IM DL850E-02EN
 - The Getting Started Guide, IM DL850E-03EN

Mean

This section explains the following settings (which are used when using the Mean filter):

- · Filter type
- Number of taps
- · Mean sample
- · Interpolation
- · Delay

CH Menu

- 1. Press a key from CH1 to CH16, and then the RealTime Math soft key to select OFF.
- 2. Press the Filter/Delay Setup soft key and then the Bandwidth soft key to select Digital. The following menu appears.

(Eltor /Dolou Cotum)		When you have selected the input channel of a frequency module
Bandwidth	– Select Digital.	Digital Filter Select ON.
Filter Type	– Select Mean.	Filter Type
© Tap	─ Set the number of taps (using th	ne jog shuttle).
Mean Sample 1M	– Set the mean sample (using the	jog shuttle).
Interpolate	Turns interpolation on and off	
Delay	Set the delay (using the jog shu	ttle).

Note_

- The same delay is used for all filter types of the same channel.
- To display the Filter/Delay Setup soft key on the setup menu that is displayed when you press a key from CH1 to CH16, press the RealTime Math soft key to select OFF.
- · If you want to perform real time math at the same time as the digital filter, press the RealTime Math soft key again to select ON.
- · For information on other features, how to use these features, and handling precautions, see the following manuals.
 - The Features Guide, IM DL850E-01EN
 - The User's Manual, IM DL850E-02EN
 - The Getting Started Guide, IM DL850E-03EN

IIR-Lowpass

This section explains the following settings (which are used when using the IIR-Lowpass filter):

- · Cutoff frequency
- Delay

CH Menu

- 1. Press a key from CH1 to CH16, and then the RealTime Math soft key to select OFF.
- **2.** Press the **Filter/Delay** Setup soft key and then the **Digital Filter** soft key to select ON. The following menu appears.

Filter/Delay Setup]			
Digital Filter	Colort ON			
	- Select ON.			
Filter Type				
IR-Lowpass	Select IIR-Lowpass.			
0.4066				
	 Set the cutoff frequency (128kHz, 64kHz, 			
	32kHz, 16kHz, 8kHz, 4kHz, 2kHz, 1kHz, 500Hz, 250Hz, 125Hz, 62,5Hz).			
🕼 Delay	– Set the delay (using the jog shuttle).			
0.0us				

Note_

- The same delay is used for all filter types of the same channel.
- To display the Filter/Delay Setup soft key on the setup menu that is displayed when you press a key from CH1 to CH16, press the RealTime Math soft key to select OFF.
- If you want to perform real time math at the same time as the digital filter, press the RealTime Math soft key again to select ON.
- For information on other features, how to use these features, and handling precautions, see the following manuals.
 - The Features Guide, IM DL850E-01EN
 - The User's Manual, IM DL850E-02EN
 - The Getting Started Guide, IM DL850E-03EN

3

Configuring Real Time Math Settings

Real Time Math Settings

This section explains the following settings (which are used when performing real time math):

- Real time math on/off
- Real time math settings
- Input settings for all channels

RMath Menu

Press a key from **CH1** to **CH16**, and then the **RealTime Math** soft key to select ON to display the following menu.

🔍 RMath1		
Display		
OFF ON	Turn root time moth on	
RealTime Math		
OFF ON	– Turn real time math on.	
Label		
RMath1		
RealTime Math		
<u>S1 + S2</u>	Configure real time math settings.	
Mean	Turne the mean on and off	
OFF ON	- Turns the mean on and off	
Optimize _	- Optimizes value/div	
Value/Div		
Novt 1/0		
NEXT 172		

Note.

• When you turn real time math on, the colors that are used to display the menu title are inverted.

When OFF Is Selected	When ON Is Selected	
CH1	🔷 RMath1 🛛 =	 The colors are inverted.
Display	Display	
OFF ON	OFF ON	
RealTime Math	RealTime Math	
OFF ON	OFF ON	

- For information on other features, how to use these features, and handling precautions, see the following manuals.
 - The Features Guide, IM DL850E-01EN
 - The User's Manual, IM DL850E-02EN
 - The Getting Started Guide, IM DL850E-03EN

Configuring Real Time Math Settings (RealTime Math Setup)

Press the RealTime Math Setup soft key to display the following screen.

Example when the Operation is S1+S2



Select an operator or function (see the operations and function that are described later in this section). Select the math source waveforms (CH1 to CH16,¹ RMath1 to RMath15²).

- 1 You can select channels in which input modules that support basic arithmetic are installed.
- 2 You can select channels whose numbers are smaller than the channel you are operating.

Menu Item	Description	
S1+S2	Basic arithmetic	Addition
S1-S2		Subtraction
S1∗S2		Multiplication
S1/S2		Division
A(S1)+B(S2)+C	Basic arithmetic with	Addition
A(S1)-B(S2)+C	coefficients	Subtraction
A(S1)*B(S2)+C		Multiplication
A(S1)/B(S2)+C		Division
Diff(S1)	Differentiation	
Integ1(S1)	Integration	Area of the positive amplitude (T-Y waveform)
Integ2(S1)		Area of the positive amplitude minus area of the negative
		amplitude (T-Y waveform)
Rotary Angle	Angle of rotation	
DA	Logic signal to analog	waveform conversion
Polynomial	Quartic polynomial	
RMS	RMS value	
Power	Effective power	
Power Integ	Effective power integra	tion
Log1	Common logarithm	Common logarithm of S1/S2
Log2		Common logarithm of S1
Sqrt1	Square root	Square root of "S1 ² \pm S2 ² "
Sqrt2		Square root of S1
Cos	Cosine	
Sin	Sine	
Atan	Arc tangent	
Electrical Angle	Electrical angle	
Knock Filter	Knocking filter (only on	the DL850EV)
Poly-Add-Sub	Polynomial with a coef	ficient
Frequency	Frequency	
Period	Period	
Edge Count	Edge count	
Resolver	Resolver	
IIR Filter	IIR Filter	
PWM	Demodulation of the Pr	ulse Width Modulated Signal
Reactive Power(Q)	Reactive power	
CAN ID	CAN ID detection	
Torque	Torque	
S1-S2(Angle)	Angle Difference	
3 Phase Resolver	3 Phase Resolver	

Operations and Functions

Note_

For details on the types of modules that support the operations and functions, see "Notes Regarding Using the Digital Filter and Real Time Math," in chapter 1.

ALL CH Menu

Press ALL CH to display the following menu.

ALL CH)
Setup	
Linear Scale	
RealTime Math -	- Configure real time math settings
CopyTo (Module)	
Strain Balance	

Note.

- · For information on other features, how to use these features, and handling precautions, see the following manuals.
 - The Features Guide, IM DL850E-01EN
 - The User's Manual, IM DL850E-02EN
 - The Getting Started Guide, IM DL850E-03EN

Configuring Real Time Math Settings for All Channels (RealTime Math)

Press the RealTime Math soft key to display the following screen.

				All	Channels Set	The on t spec	displaye he real ti cified for Math)	d contents me math c the chann	s vary depending operation that ha nel at the cursor
		R Math	Label	V/div	Operation	Source1	Source2	К	
1	Ē	ON	RMath1	1.000E+00	S1 + S2	CH1	CH2		
2		0FF	RMath2	1.000E+00	S1 + S2	CH1	CH2		
3		0FF	RMath3	1.000E+00	S1 + S2	CH1	CH2		
4		0FF	RMath4	1.000E+00	S1 + S2	CH1	CH2		
5		0FF	RMath5	1.000E+00	S1 + S2	CH1	CH2		
6		0FF	RMath6	1.000E+00	S1 + S2	CH1	CH2		
7		0FF	RMath7	1.000E+00	Log1	CH1	CH2	1.0000	
8		0FF	RMath8	1.000E+00	S1 + S2	CH1	CH2		
9		0FF	RMath9	1.000E+00	S1 + S2	CH1	CH2		
10		0FF	RMath10	1.000E+00	S1 + S2	CH1	CH2		
11		0FF	RMath11	1.000E+00	S1 + S2	CH1	CH2		
12		0FF	RMath12	1.000E+00	S1 + S2	CH1	CH2		
13		0FF	RMath13	1.000E+00	S1 + S2	CH1	CH2		
14		0FF	RMath14	1.000E+00	S1 + S2	CH1	CH2		
15		0FF	RMath15	1.000E+00	S1 + S2	CH1	CH2		
16		0FF	RMath16	1.000E+00	S1 + S2	CH1	CH2		

Use the jog shuttle to move the cursor to the item that you want to set.

position.

Basic Arithmetic (S1+S2, S1-S2, S1*S2, and S1/S2)

The following screen appears when you select a basic arithmetic operation.

	RealTime Math Setup		
Select the operation.		S1+S2	Operation
		CH1	Source1
- Select the math source waveforms.	J	CH2	Source2

Basic Arithmetic with Coefficients (A(S1)+B(S2)+C, A(S1)-B(S2)+C, A(S1)*B(S2)+C, and A(S1)/B(S2)+C)

The following screen appears when you select a basic arithmetic operation with coefficients.

]	me Math Setup	RealTi
Select the operation.	A(S1)+B(S2)+C	Operation
Select the math course wayoforms	CH1	Source1
Select the math source wavelorms.	CH2	Source2
	[]	А
Set the coefficients (using the jog shuttle).	1.0000	В
	0.0000	C

Differentiation (Diff(S1))

The following screen appears when you select the differentiation function.



Integration (Integ1(S1) and Integ2(S2))

The following screen appears when you select an integration function.

RealTir	me Math Setup	
Operation	Integ1(S1)	Select the function.
Source	CH1	Select the math source waveform.
Reset Condition	✓Start	Reset conditions for the integration result
	□ Overlimit	When waveform acquisition starts
	□ ZeroCross	• When "Value/Div" exceeds +10 div or falls below –10 div
		When the math source waveform
		crosses zero and an edge is generated
Manual Reset	Execute	Resets the integration result

Angle of Rotation (Rotary Angle)

The following screen appears when you select the angle-of-rotation function.

• When the Encoding Type Is Incremental ABZ, Incremental AZ, Absolute 8bit, or Absolute 16bit

RealTir	ne Math Setup	Select the function.
Operation Type	Rotary Angle	Select the encoding type (Incremental ABZ, Incremental AZ, Absolute 8bit,
Source Condition		ADSOLUTE 16DIT).
	Setup	Set the source conditions.
Pulse/Rotate	180	Set the number of pulses per rotation (using the jog shuttle).
Scaling	User Define	Select the scale (Radian, Degree, User Define).
K	1.0000	Set the size of the scale (only when Scaling is set to User Define) (using the jog shuttle).
Manual Porot	Setup	Set the encoding conditions. You can set the conditions when the encoding type is ABZ or AZ
Mandal Reset	LACOLE	Resets the math result

• When the Encoding Type Is Gray Code

RealTi	me Math Setup	
Operation	Rotary Angle	—Select the function.
Туре	Gray Code	—Select the encoding type (Gray Code).
Source Condition	Setup	—Set the source conditions.
Bit Length	16	—Set the bit length (using the jog shuttle).
Scaling	User Define	—Select the scale (Radian, Degree, User Define).
К	1.0000	-Set the size of the scale (only when Scaling is set to User Define) (using the jog shuttle).

Setting the Source Conditions

Under Source Condition, press Setup to display the following screen.

 When the Encoding Type Is Incremental ABZ or Incremental AZ and When the Logic Source Is Off

Source Condition	
Logic Source OFF ON	Turn logic sources off.
Phase A-	
Level 0.0V	
Hysteresis 📈 🗡 🖂	Set the hysteresis ($ earrow$, $ earrow$, $ earrow$).
CH2	
Hysteresis 🗡 🗡 📈	
Phase Z	
CH1 ØPhase Z Invert	Select the check box when the Z-phase input is inverted.
Level	
	J
Set the signal level that yo	ou want to count (using the jog shuttle).

Select the signal channels for phases A, B, and Z of the analog waveform module.

When the Encoding Type Is Incremental ABZ or Incremental AZ and When the Logic Source Is On

Source Con	dition	
Logic Source 🚺	DFF ON -	Turn logic sources on.
Source	CH3	Select the input channel of the logic module.
Phase A	Bit1	The channels of installed logic modules are displayed.
Phase B	Bit2	Select the bits of logic signals of
Phase Z	Bit3	phases A, B, and Z (Bit1 to Bit8).
⊘ Phâ	se Z Invert ———	Select the check box when the Z-phase input is inverted.

• When the Encoding Type Is Absolute 8bit

Sou	rce Condition
Logic Source	OFF
Source	СНЗ —

- Select the input channel of the logic module. The channels of installed logic modules are displayed.

· When the Encoding Type Is Absolute 16bit or Gray Code

Logic Source	OFF	UN
Source1	CH3	
Source2	CH3	

Select the math source logic signal (least significant 8 bits). The channels of installed logic modules are displayed. Select the math source logic signal (most significant 8 bits). The channels of installed logic modules are displayed.

* When the bit length of Gray Code is 8 or less, the Source2 setting is ignored.

Setting the Encoding Conditions

Under Encode Condition, press Setup to display the following screen.

Enc	ode Condition
Count Condition	x2
Timing1	L A F
Timing2	A 2
Reset Timing	Z Level
Reverse	

Set the count condition (x4, x2, x1).

Select the edge to count pulses on (A f, A c, B f, B c). This is displayed when Count Condition is set to x2 or x1.

Select the edge to count pulses on (A f, A f, B f, B f). This is displayed when Count Condition is set to x2.

Select the edge that you want to use to trigger a reset operation (A f, A \downarrow , B f, B \downarrow , Z Level).

Turns rotation direction inversion on and off

Logic Signal to Analog Waveform Conversion (DA)

The following screen appears when you select the logic signal to analog waveform conversion function.

RealTi	ime Math Setup		5
Operation	DA		S
Source1	CH3		T
Source2	CH3	[י פ ד
Туре	Unsigned	\rightarrow +	S
Bit Length	16	+	S
К	1.0000		S

Select the function.

Select the math source logic signal (least significant 8 bits). The channels of installed logic modules are displayed. Select the math source logic signal (most significant 8 bits). The channels of installed logic modules are displayed. Select the conversion method (Unsigned, Signed, Offset Binary). Set the bit length (using the jog shuttle). Set the coefficient (using the jog shuttle).

Quartic Polynomial (Polynomial)

The following screen appears when you select the quartic polynomial function.

RealTir	ne Math Setup	
Operation	Polynomial	Select the function.
Source	CH1	Select the math source waveform.
А	1.0000	
В	1.0000	
С	0.0000	Set the coefficients (using the jog shuttle).
D	0.0000	
E	0.0000	

RMS Value (RMS)

The following screen appears when you select the RMS value function.

• If the Calculation Period Is Edge

RealTi	me Math Setup		
Operation	RMS		Select the function.
Source	CH1		Select the math source waveform.
Calc Period	Edge	Time	Set the calculation period to Edge.
-Calc Period-			
Edge Source	Own		Select the edge detection source
Level	0.0		(Own, CH1 to CH16 ¹ , RMath1 to RMath15 ²).
Slope	F 1		Set the level (using the jog shuttle).
Hysteresis	#		ー Set the edge detection condition (チ, ᡫ, チᡫ). ー Set the hysteresis (// , // , <u>//</u>).

- 1 You can select channels in which input modules that support basic arithmetic are installed.
- 2 You can select channels whose numbers are smaller than the channel you are operating.

• If the Calculation Period Is Time

RealTime Math Setup	
Operation RMS	Select the function.
Source CH1	Select the math source waveform.
Calc Period Edge Time	Set the calculation period to Time.
Time 1ms	Set the time (using the jog shuttle).

Effective Power (Power)

The following screen appears when you select the effective power function.

Select the function.
Select the math source waveforms
Select the math source wavelonns.
 Select the edge detection source
(Source1, Source2, CH1 to CH16 ¹ , RMath1 to RMath15 ²).
Set the level (using the jog shuttle).
$-$ Set the edge detection condition (\pm , \pm , \pm).
Set the hysteresis ($\not\!$

- 1 You can select channels in which input modules that support basic arithmetic are installed.
- 2 You can select channels whose numbers are smaller than the channel you are operating.

Effective Power Integration (Power Integ)

The following screen appears when you select the effective power integration function.

RealTi	ne Math Setup	
Operation	Power Integ	Select the function.
Source1	CH1	Select the math source waveforms.
Source2	CH2	
Reset Condition	☑ Start —	Reset conditions for the integration result
		• When waveform acquisition starts
	□Overlimit —	• When "Value/Div" exceeds +10 div or falls below –10 div
Manual Reset	Execute	Resets the integration result
Scaling	Second Hour	Select the scale (Second, Hour).
Source2 Reset Condition Manual Reset Scaling	OH1 OH2 ØStart Overlimit Execute Second	Reset conditions for the integration result - • When waveform acquisition starts - • When "Value/Div" exceeds +10 div or falls below –10 div - Resets the integration result - Select the scale (Second, Hour).

Common Logarithm (Log1 and Log2)

Log1

The following screen appears when you select the common logarithm function (Log1).

RealT	me Math Setup	
Operation	Log1	Select the function.
Source1	CH1	
Source2	CH2	- Select the math source waveforms.
к	1.0000	Set the coefficient (using the jog shuttle).

• Log2

The following screen appears when you select the common logarithm function (Log2).

	me Math Setup	RealTin
Select the function.	Log2	Operation
Select the math source waveform.	CH1	Source
Set the coefficient (using the jog shuttle	1.0000	К

Square Root (Sqrt1 and Sqrt2)

Sqrt1

The following screen appears when you select the square root function (Sqrt1).

		Math Setup	RealTin
Select the function.	_	Sqrt1	Operation
Select the math source waveforms		CH1	Source1
Gelect the math source wavelorms.	Ð	CH2	Source2
Select the sign (+, –).		• -	Sign

Note.

When you set Sign to +, the square root of "S1² + S2²" is calculated. When you set Sign to –, the square root of "S1² – S2²" is calculated.

Sqrt2

The following screen appears when you select the square root function (Sqrt2).

Real I Im	e Math Setup	
Operation	Sqrt2 -	Select the function.
Source	CH1 -	Select the math source waveform.

Cosine (Cos) and Sine (Sin)

The following screen appears when you select the cosine or sine function.

• When the Encoding Type Is Incremental ABZ, Incremental AZ, Absolute 8bit, or Absolute 16bit

RealTi	ime Math Setup	
Operation	Cos	— Select the function.
Type	Setun	 Select the encoding type (Incremental ABZ, Incremental AZ, Absolute 8bit, Absolute 16bit).
		Set the source conditions.
Pulse/Rotate	180	 Set the number of pulses per rotation (using the jog shuttle).
Encode Condition	Setup -	— Set the encoding conditions.*
Manual Reset	Execute	Resets the math result *

* You can set the conditions when the encoding type is ABZ or AZ.

• When the Encoding Type Is Gray Code

RealTime Math Setup	
Operation Cos	— Select the function.
Type Gray Code	— Select the encoding type (Gray Code).
-Source Condition-	— Set the source conditions.
Bit Length 16	- Set the bit length (using the jog shuttle)

• When the Encoding Type Is Resolver Ch

You can only configure the settings when there is a channel that has been defined with the resolver function.



* You can select channels whose numbers are smaller than the channel you are operating.

Setting the Source Conditions

Under Source Condition, press Setup to display the following screen.

 When the Encoding Type Is Incremental ABZ or Incremental AZ and When the Logic Source Is Off

Source Condition]
Logic Source OFF ON	Turn logic sources off.
CH2	
Level 0.0V	
Hysteresis 🗡 🗡 🗍	Set the hysteresis ($\not\!$
Phase B	
CH2	
Level 0.0V	
Hysteresis 📈 🗡 📈	
-Phase 7	
CH1 @Phase Z Invert	Select the check box when the Z-phase
Level 0.0V	
Hysteresis 📈 🗯 ⊄	
	J
Set the signal level that	you want to count (using the jog shuttle).

Select the signal channels for phases A, B, and Z of the analog waveform module.

 When the Encoding Type Is Incremental ABZ or Incremental AZ and When the Logic Source Is On

	Source Condition	Sour
Turn logic sources on.	rce OFF ON	Logic Source
Select the input channel of the logic module.	rce CH3	Source
The channels of installed logic modules are displayed.	A Bit1	Phase A
Select the bits of logic signals of phases	B Bit2	Phase B
A, B, and Z (Bit1 to Bit8).	Z Bit3	Phase Z
Select the check box when the Z-phase input is inverted	∎Phase Z Invert —	

• When the Encoding Type Is Absolute Encode 8bit

Logic Source	OFF	N
Source	CH3	_

Select the input channel of the logic module. The channels of installed logic modules are displayed.

• When the Encoding Type Is Absolute Encode 16bit or Gray Code

So	urce Condition	
Logic Source	OFF III	- Sel
Source1	СНЗ	The
Source2	CH3 -	- Sel
I		' (mo The

Select the math source logic signal (least significant 8 bits). The channels of installed logic modules are displayed. Select the math source logic signal (most significant 8 bits). The channels of installed logic modules are displayed.

* When the bit length of Gray Code is 8 or less, the Source2 setting is ignored.

Setting the Encoding Conditions

Under Encode Condition, press Setup to display the following screen.

Enc	ode Condition	
Count Condition	×2	ЭĮ
Timing1	E A	ЭЛ
Timing2	(Ał	3
Reset Timing	Z Level	31
Reverse	OFF ON	٦Ì
<u> </u>		

- Set the count condition (x4, x2, x1).

- Select the edge to count pulses on (A f, A t, B f, B t). This is displayed when Count Condition is set to x2 or x1.

- Select the edge to count pulses on (A f, A c, B f, B c). This is displayed when Count Condition is set to x2.

Select the edge that you want to use to trigger a reset operation $(A \preceq A \downarrow, B \preceq B \preceq A \downarrow, Z \text{ Level})$.

Turns rotation direction inversion on and off

Arc Tangent (Atan)

The following screen appears when you select the arc tangent function.

RealTin	ne Math Setup	
Operation	Atan	 Select the function.
Source1	CH1	Soloct the math source waveforms
Source2	CH2	
Scaling	Radian Degree	 Select the scale (Radian, Degree).
Quadrant	Quadrant-2 Quadrant-4	 Select the quadrant range (Quadrant-2, Quadrant-4).

Electrical Angle (Electrical Angle)

The following screen appears when you select the electrical angle function.

• When the Encoding Type Is Incremental ABZ, Incremental AZ, Absolute 8bit, or Absolute 16bit

RealTi	me Math Setup	-Select the function.
Operation Type	Electrical Angle	Select the encoding type (Incremental ABZ, Incremental AZ, Absolute 8bit, Absolute 16bit).
Source Condition	Setup -	—Set the source conditions.
Pulse/Rotate	180	-Set the number of pulses per rotation (using the jog shuttle).
Scaling	Radian Degree	—Select the scale (Radian, Degree).
Encode Condition	Setup	—Set the encoding conditions. You can set the conditions when the encoding type is
Target	CH1	ABZ or AZ.
1		-Select the target (CH1 to CH16 ¹ , RMath1 to RMath15 ²).

• When the Encoding Type Is Gray Code

ĺ	RealTime Math Setup		
	Operation	Electrical Angle	Select the function.
	Туре	Gray Code	—Select the encoding type (Gray Code).
	-Source Condition	Setup	Set the source conditions.
	Bit Length	<u> </u>	Set the bit length (using the jog shuttle).
	Scaling	Radian Degree	Select the scale (Radian, Degree).
	Target	CH1	—Select the target (CH1 to CH16 ¹ , RMath1 to RMath15 ²).

• When the Encoding Type Is Resolver Ch

You can only configure the settings when there is a channel that has been defined with the resolver function.

RealTime Math Setup		
Operation	Electrical Angle	—Select the function.
Туре	Resolver Ch	—Select the encoding type (Resolver Ch).
Resolver Ch	RMath1	Select the resolver channel ² The channels that have been defined with the resolver function are displayed.
Scaling	Radian Degree	—Select the scale (Radian, Degree).
Target	CH3	—Select the target (CH1 to CH16 ¹ , RMath1 to RMath15 ²).

- 1 You can select channels in which input modules that support basic arithmetic are installed.
- 2 You can select channels whose numbers are smaller than the channel you are operating.

Setting the Source Conditions

Under Source Condition, press Setup to display the following screen.

· When the Encoding Type is Incremental ABZ or Incremental AZ

		Source Condition		Sour
		IN	OFF	Logic Source
Select the input channel of the logic module.	3-8	CH3 –		Source
The channels of installed logic modules are displayed.	י וכ	Bit1		Phase A
Select the bits of logic signals of phases	═┾╴	Bit2		Phase B
A, B, and Z (Bit1 to Bit8).	_J /	Bit3		Phase Z
Select the check box when the Z-phase input is inv		Invert	∎Phase Z	

Note_

You cannot use analog waveforms as sources.

• When the Encoding Type Is Absolute 8bit

Source Condition	
Logic Source	OFF
Source	CH3 -

- Select the input channel of the logic module. The channels of installed logic modules are displayed.

• When the Encoding Type Is Absolute 16bit or Gray Code



Select the math source logic signal (least significant 8 bits). The channels of installed logic modules are displayed. Select the math source logic signal (most significant 8 bits). The channels of installed logic modules are displayed.

* When the bit length of Gray Code is 8 or less, the Source2 setting is ignored.

Setting the Encoding Conditions

Under Encode Condition, press Setup to display the following screen.

Enc	ode Condition	
Count Condition	x2	ЭĮ
Timing1	A F	ЪГ
Timing2	A Ł	3+
Reset Timing	Z Level	3
Reverse	OFF ON	Эľ

Set the count condition (x4, x2, x1).

Select the edge to count pulses on (A f, A f, B f, B f). This is displayed when Count Condition is set to x2 or x1. Select the edge to count pulses on (A f, A f, B f, B f). This is displayed when Count Condition is set to x2.

Select the edge that you want to use to trigger a reset operation (A ـ ƒ, A 군 , B ـ ƒ, B 군 , Z Level).

Turns rotation direction inversion on and off

Knocking Filter (Knock Filter; only on the DL850EV)

The following screen appears when you select the knocking filter function.

	me Math Setup	RealT
Selec	Knock Filter	Operation
Selec	CH1	Source
Set th	0mV	Elimination Level
Turns		Differential

Select the function. Select the math source waveform. Set the elimination level (using the jog shuttle). Furns differentiation on and off

Polynomial with a Coefficient (Poly-Add-Sub)

The following screen appears when you select the polynomial with a coefficient function.

	RealTime Math Setup	
Select the function.	Operation Poly-Add-Sub	0
	Source1 (+) CH1	:
	Source2 + CH2	:
- Select the math source waveforms.	Source3 + CH1	:
	Source4 + CH1	
 Set the coefficient (using the jog shuttle). 	К 1.0000	
Set the coefficient (using the jog shuttle).	Source4 + CH1	

Select the sign (+, -).

Press SET to switch between the positive and negative signs.

Frequency (Frequency)

The following screen appears when you select the frequency function.

	RealTime Math Setup	
- Sele	Frequency	Operation
Sele	CH1	Source
- Set t	<u> </u>	Slope
- Set f	0.00	Level
- Set f	₩ # <u></u>	Hysteresis
Sele	Hz Rpm	Scaling
Sele	OFF ON -	Deceleration Prediction
- Sele	OFF	Stop Prediction
- Set f	0.0000	Offset(Hz/Rpm)

Select the function. Select the math source waveform. Set the edge detection condition (f, +). Set the level (using the jog shuttle). Set the hysteresis (++, +++, -+++). Select the scale (Hz, Rpm).

Select the deceleration prediction (OFF, ON). Select the stop prediction (OFF, 2, 4, 8, 16). Set the offset value (using the jog shuttle).

Period (Period)

The following screen appears when you select the period function.

		me Math Setup	RealTi
Select the function.	<u> </u>	Period	Operation
Select the math source waveform.		CH1	Source
Set the edge detection condition (f , f).	1	5	Slope
Set the level (using the jog shuttle).		V00.0	Level
\neq Set the hysteresis (\not , \not , \not , \not).		# #	Hysteresis
Select the deceleration prediction (OFF, ON).		OFF	Deceleration Prediction
Select the stop prediction (OFF, 2, 4, 8, 16).		OFF	Stop Prediction

Edge Count (Edge Count)

The following screen appears when you select the edge count function.



Resolver (Resolver)

The following screen appears when you select the resolver function.

RealTi	me Math Setup)	
Operation	Resolver	Select the funct	ion.
Sin Ch	CH3	Select the sine p	bhase signal (CH1 to CH16 ¹ , RMath1 to RMath15 ²).
Cos Ch	CH1	Select the cosin	e phase signal (CH1 to CH16 ¹ , RMath1 to RMath15 ²).
Carrier Ch	CH3	Select the excita	ation signal (CH1 to CH16 ¹ , RMath1 to RMath15 ²).
Hysteresis	# # #	Set the hysteres	sis (, / , , / /).
Tracking Filter	OFF	Select the track	ng filter (OFF, 2kHz, 1kHz, 250Hz, 100Hz).
Detail	Setup		
	Detail Setting Resolver Deta Sample Point Mode Au Time	il Setup <u>ito Manual</u>	Configure the sample point. • Set the Mode (Auto, Manual). Only when Mode is set to Manual • Set the move time of the sample point
	Scaling Offset(°)	-180° - +180° -	(using the jog shuttle). – Select the scale (–180° – +180° , 0° – 360° , $-\pi$ – + π , 0 – 2 π).
		L	- Set the offset value (using the jog shuttle).

- 1 You can select channels in which input modules that support basic arithmetic are installed.
- 2 You can select channels whose numbers are smaller than the channel you are operating.

IIR Filter (IIR Filter)

The following screen appears when you select the IIR filter function.

· When Filter Band Is Set to Low-Pass or High-Pass

RealTi	ime Math Setup	
Operation	IIR Filter	 Select the function.
Source	CH1	Select the math source waveform.
Filter Band	Low-Pass	– Set the filter band (Low-pass, High-Pass).
CutOff	0.30MHz	 Set the cutoff frequency (using the jog shuttle).
Interpolate	OFF ON	– Turns interpolation on and off.

• When Filter Band Is Set to Band-Pass

RealTir	ne Math Setup	
Operation	IIR Filter	- Select the function.
Source	CH1	Select the math source waveform.
Filter Band	Band-Pass	– Set the filter band (Band-pass).
Center Frequency	0.30kHz	 Set the center frequency (using the jog shuttle).
Pass Band	200Hz -	– Set the bandwidth (using the jog shuttle).
Interpolate	OFF ON	 Turns interpolation on and off.

Demodulation of the Pulse Width Modulated Signal (PWM)

When you select the function that is used to demodulate pulse width modulated signals, the following screen appears.



Reactive Power (Reactive Power(Q))

The following screen appears when you select the reactive power (Q) function.

RealTime Math Setup		
Operation	Reactive Power(Q)	
Apparent Power(S)	RMath7	
Effective Power(P)	RMath8	
Voltage	СНЗ	
Hysteresis	<u>₩</u> # <u>₩</u>	
Current	CH4	

Select the function.

Select the real time math channel (RMath channel) used to calculate the apparent power. Select the real time math channel (RMath channel)

used to calculate the effective power.

Select the voltage channel used to derive the reactive power.

Set the hysteresis for the selected voltage. (earrow
earrow , earrow
earrow , earrow
earro

Select the current channel used to derive the reactive power.

CAN ID Detection (CAN ID)

The following screen appears when you select the CAN ID function.

RealTime Math Setup	
Operation CAN ID	Select the function.
Source CH1	Select the detection source waveform.
Bit Rate 500Kbps	Select the bit rate
Message Format STD XTD	(10k, 20k, 33.3k, 50k, 62.5k, 66.7k, 83.3k, 100k, 125k, 200k, 250k, 400k, 500k, 800k, 1Mbps).
ID (Hex) 0x000	Select the message format (STD, XTD).
	– Set the message ID.

Torque (Torque)

The following screen appears when you select the torque function.

RealTi	me Math Setup	
Operation	Torque	[—] Select the function.
Source	CH1	Select the detection source waveform.
Slope	<u> </u>	$-$ Set the edge detection condition (f, \downarrow).
Level	0.0	– Set the level (using the jog shuttle).
Hysteresis		– Set the hysteresis ($ earrow$, $ earrow$, $ earrow$).
Deceleration Prediction	OFF	– Select the deceleration prediction (OFF, ON).
Stop Prediction	OFF	– Select the stop prediction (OFF, 2, 4, 8, 16).
А	1.0000	— Set the coefficient (using the jog shuttle).
С	0.0000	– Set the coefficient (using the jog shuttle).

Angle Difference (S1-S2(Angle))

The following screen appears when you select the angle difference function.


3 Phase Resolver (3 Phase Resolver)

The following screen appears when you select the 3 phase resolver function.

Realli	me Math Setup	
Operation	3 Phase Resolver	- Select the function.
Phase	0° - 120°	− Select the phase of the sine signal (0°− 120°, 0°− 240°, 120°− 240°).
Sin0° Ch	CH3	Select the size phase signal (CH1 to CH16 $\frac{1}{2}$ PMath1 to PMath15 ²)
Sin120° Ch	CH1	-Select the sine phase signal (CHT to CHTO, "Kmath to Kmath").
Carrier Ch	CH1	- Select the excitation signal (CH1 to CH16, ¹ RMath1 to RMath15 ²).
Hysteresis	<u>₩</u> # <u>≭</u>	– Set the hysteresis ($\not\!$
Tracking Filter	OFF	Select the tracking filter (OFF, 2kHz, 1kHz, 250Hz, 100Hz).
Detail	Setup	
	Detail Setting	
	Resolver Deta	il Setup Configure the sample point.
	-Sample Point	Set the Mode (Auto, Manual).
	Mode A	
		Only when Mode is set to Manual
	Time	• Set the move time of the sample point (using the jog shuttle).
	Scaling	
	Offset(°)	$0.00 \qquad \qquad$
		Set the offset value (using the jog shuttle).

- 1 You can select channels in which input modules that support basic arithmetic are installed.
- 2 You can select channels whose numbers are smaller than the channel you are operating.

4

Configuring the Power Math Feature

Power Math

This section explains the following settings (which are used when performing power math).

- Power analysis: Analyzes rms voltage, power, phase difference, and other types of physical quantities.
- Harmonic analysis: Analyzes the harmonics of rms values (voltage and current) and the harmonics of active power.
- CH menu: Display settings of waveforms output to sub channels.

For details on how various physical quantities are determined, see the appendix.

ANALYSIS Menu

Press ANALYSIS to display the following menu.

ANALYSIS Power 2 Wirig Systems Image: System stress Image: System stres <th>- Configure power analysis. - Configure harmonic analysis.</th>	- Configure power analysis. - Configure harmonic analysis.
Digital Monitor Mode - Display Group	- Set the numeric monitor (Display Group, Power, Harmonic).
 [⊲] Operate Power Analysis [⊲] Harmonic Window Setup 	 Set the Power analysis operation. Not displayed when the power analysis mode is set to OFF Configure the harmonic analysis window. Not displayed when the harmonic analysis mode is set to OFF

Power Analysis (Power)

The following settings (which are used when analyzing power) are explained.

- · Power analysis mode
- · Power analysis items
- Power analysis reset

Setting the Power Analysis Mode (Power)

Press the **Power** soft key to display the following screen.

Display example when the analysis mode is set to 2 Wiring System



Detail Setting (Detail)

Press Setup... to display the following screen.

• When the calculation period type is set to Edge

Wiring System	n 1 Detail Setup	
Calc Period-		
Туре 🧧	Edge	Select the calculation period type.
Edge Source	UI	Select the edge detection source [*] (U1, I1, Other Channel, Own U, Own I).
Hysteresis	<u>₩</u> # #	Set the hysteresis ($\not\!$
Edge Source Filter	OFF	Set the edge source filter (OFF, 128kHz 64kHz, 32kHz, 16kHz, 8kHz, 4kHz, 2kHz, 1kHz, 500Hz, 250Hz, 125Hz, 62.5Hz).
Analysis Setting	Setup	Analysis settings
Efficiency Setting	Setup	Efficiency settings

Other Channel can be specified when the wiring system is 1P2W.
 Own U and Own I can be specified when the wiring system is not 1P2W.

• When the calculation period type is set to Auto Timer

Wiring System 1 Detail Setup]
Calc Period	 Select the calculation period type. Set the update time (using the jog shuttle).
Analysis Setting Setup	Analysis settings
Efficiency Setting Setup	Efficiency settings

• When the calculation period type is set to AC

Wiring System 1 Detail Setup	1
Calc Period	
Type AC	Select the calculation period type.
Edge Source U1	Select the edge detection source [*] (U1, I1, U2, I2, U3, I3, Other Channel).
Hysteresis 📈 🗡 📈	Set the hysteresis ($ earrow$, $ earrow$, $ earrow$).
Edge Source Filter	Set the edge source filter (OFF, 128kHz,
Stop Prediction 2	1kHz, 500Hz, 250Hz, 125Hz, 62.5Hz).
	└─ Set the stop prediction (2, 4, 8, 16).
Analysis Setting Setup	Analysis settings
Efficiency Setting Setup	Efficiency settings

* Other Channel can be specified when the wiring system is 1P2W.

• When the calculation period type is set to AC+DC

Wiring Sys	stem 1 Detail Setup	
Calc Period-		
Туре	AC+DC -	Select the calculation period type.
Edge Source	(U1	Select the edge detection source [*] (U1, I1, U2, I2, U3, I3, Other Channel).
Hysteresis	<u>₩</u> # <u>#</u> -	Set the hysteresis (/√ , / ↓, ////.
Edge Source Filter	OFF -	Set the edge source filter (OFF, 128kHz,
Stop Prediction	2 -	1kHz, 500Hz, 250Hz, 125Hz, 62.5Hz).
Auto Timer	0.0001ms -	Set the stop prediction (2, 4, 8, 16).
Analysis Setting	Setup	Set the update time (using the log shuttle).
Efficiency Setting	Setup	Analysis settings
		Efficiency settings

* Other Channel can be specified when the wiring system is 1P2W.

Analysis Setting (Analysis Setting)

Press Setup... to display the following screen.

Wiring System 1 Analysis Setup	
RMS Type True RMS Rect. Mean —	Select the RMS type (True RMS, Rect. Mean).
Φ Scale Radian Degree	Select the ϕ scale (Radian, Degree).
Integration Setup Condition All times In Acquisition Reset on Start OFF UN Scaling Second Hour	—Set the integration condition (All times, In Acquisition) —Set reset-at-start (OFF, ON). —Set the scaling (Second, Hour).

Efficiency Setting (Efficiency Setting)

Press **Setup...** to display the following screen.

When the efficiency mode is set to Power



• When the efficiency mode is set to Motor

Wiring System 1 Efficiency Setup	
Mode Motor -	 Select the efficiency mode (OFF, Power, Motor).
η = (Pm / #1_P Σ) * 100 (%)	
Pm Setup	
Pm Type RotationAngle Speed	— Select the Pm type (RotationAngle, Speed).
$Pm = K \times (2 \times \pi \times Speed) \times Torque$	
К 1.0000	— Set coefficient K (using the jog shuttle).
Speed CH1	 Select the channel used to derive the rotating speed.
Scaling rps rpm	— Select the scaling (rps, rpm).
Torque CH1	 Select the channel used to derive the torque.

Selecting Power Analysis Items (Power Analysis Item)

Press the **Power Analysis Item** soft key to display the following screen.

Display example when the analysis mode is set to 2 Wiring Systems and the wiring system is set to 1P2W

	Set all out (clear the o	put items to OFF check boxes).		Output i	items	
	Pe	ower Analysis Item			Analysis Item]
rinį System 1—				_		
√ U ms1	§ jirms1	Idc1	ldc1	A		
√ Uic1	Ilac1	⊘ P1	⊘ S1			
₹Q	δ 1λ1	Ø ¢1	Interpretation of the second seco		►	<
√ fl	€ JU+pk1	⊘ U−pk1	I rpk1			
7	€ ID+old	P-nk1	WP1			
VI-DKI	IL ± bK1	Mi pri				
⊘ ₩ +1	6 WP-1	I pki I I I I I I I I I I I I I I I I I I I	✓q+1			
⊘ ⊪⊃κτ ⊘ ₩ ² +1 ⊘ q ·1	6 WP-1 6 WS1	Ør pk1 Øq1 Ø₩Q1	Øq+1 ØZ1			<
	6 JP-19K1 6 JWP-1 6 JWS1 6 JXS1 All OFF	Øq1 Øq1 ØRP1	©dq+1 ØZ1 ØXP1		All Output Items - Setup	Set all output ite See "CH Menu" la in this section.
gr pk1 gW +1 gR 1 gR 1 All ON 	6 WP-1 6 WS1 6 IXS1 All OFF	© (1 Øq1 ØWQ1 ØRP1	Øq+1 ØZ1 ØXP1		All Output Items - Setup	Set all output ite See "CH Menu" la in this section.
✓ %1 ✓₩ ² +1 ✓¶ ¹ 1 ✓R ¹ 1 ✓R ¹ 1 ✓R ¹ 1 ✓R ¹ 1 ✓II ON ✓Urms 1	6 WP-1 6 W9-1 6 W81 6 IXS1 All OFF	of prot of q1 of with Q1 of RP1	Ødet1 ØZ1 ØXP1 Økc1		All Output Items	Set all output ite See "CH Menu" la in this section.
Ø %1 Ø 1 Ø 1 Ø 1 Ø 1 Ø 1 Ø 1 Ø 0 N Ø 1 Ø 0 N Ø 0 N System 2− Ø 0 Wms1 Ø 0 0 0	6 WP-1 6 WS1 7 WInns1 Ølac1 Ølac1	© 1 Øq1 ØWQ1 ØRP1 ØUdc1 ØP1	@ldc1 @ldc1 @S1	ţ	All Output Items - Setup	Set all output ite See "CH Menu" la in this section.
Ø %1 Ø 1 Ø 1 All ON All ON Ø 0 Ø 0 Ø 0 Ø 0 Ø 0 Ø 0 Ø 0 Ø 0 Ø 0 Ø 0	Øllm 1 Øllm 1 Øllm 1 Øllms1 Øllms1 Øllact Øll 1	© 1201 Øq1 ØWQ1 ØRP1 ØUdc1 ØP1 Ø01	Øldc1 Øldt1 ØS1 ØfU1		All Output Items - Setup	Set all output ite See "CH Menu" la in this section.
Win Win	ØIFTPA1 ØWP-1 ØWS1 ØIXS1 ØIRms1 ØIac1 ØA1 ØD+pk1	© prot © q1 © WQ1 ©	Ødq+1 ØZ1 ØZ21 ØXP1	v	All Output Items - Setup	Set all output ite See "CH Menu" la in this section.
win win win win win i win i win i win win win	ØIFTPA1 ØIWP-1 ØIWS1 ØIXS1 ØIRms1 ØIac1 ØA1 ØI+pk1 ØI+pk1	© pri Øq1 ØWQ1 ØRP1 ØUdc1 ØP1 Ø01 ØU-pk1 ØP-pk1	Ød+1 ØZ1 ØZ21 ØXP1 ØXP1 ØXP1		All Output Items -	Set all output ite See "CH Menu" la in this section.
win win win win win 1	ØIFTPA1 6 WP-1 6 WS1 7 WS1 7 WS1 7 WS1 7 WS1	Ør prot Ørd1 Ørl91 Ørl91 Ørl91 Ørl91 Ørl91 Ørl91 Ørl91 Ørl91	Ølq+1 Ølq+1 Ølz1 Ølz1 Øls1 Øls1 Øls1 Øls1 Ølq+pk1 ØlwP1 Ølq+1 Ølg+1		All Output Items - Setup	Set all output ite See "CH Menu" la in this section.
V PK1 V	Ølrms1 Ølrms1 Ølrms1 Ølrms1 Ølrms1 Ølrms1 Ølrms1 Ølrms1 Ølrms1	Ørd1	Ølq+1 Ølq+1 Ølz1 Øldc1 Øls1 Øls1 Ølq+1 Ølq+1 Ølq+1 Ølq+1		All Output Items -	Set all output ite See "CH Menu" la in this section.

Display example when the analysis mode is set to 1 Wiring System and the wiring system is set to 1P3W

ZUrmsΣ	⊡Urms1	Urms2	A
√ lrmsΣ	⊡lrms1	⊡lrms2	
✔UdcΣ	⊡Udc1	_Udc2	
ZldcΣ	⊡ldc1	⊡ldc2	
√ UacΣ	⊡Uac1	□Uac2	
ZlacΣ	⊡lac1	⊡lac2	
ΖΡΣ	OP1	_P2	
ZSΣ	_\$1	\$2	
ΖQΣ	_Q1	_Q2	
ΖλΣ	□λ1	_λ2	
ζφΣ	_001	002	
	√ fU1	Interpretation of the second seco	
	⊘ fl1	Image: March 100 million	
	⊘ U+pk1	⊘ U+pk2	
	⊘ U−pk1	⊘ U-pk2	
	⊘ l+pk1	√ I+pk2	
	⊘ I−pk1	√ I-pk2	
	✓P+pk1	✓P+pk2	
	✓P-pk1	✓P-pk2	
ZWPΣ	O₩P1	OWP2	
ZHh+Σ	_₩P+1	_₩P+2	•

Resets the output item selection to the default condition. This is available when the wiring system is not 1P2W.

Power Analysis Reset (Operate Power Analysis) Press the Operate Power Analysis soft key to display the following screen.



Press the Execute Manual Reset for Integration soft key to display the following screen.

Manual Reset))	
Exec Reset Wiring System 1	ñ J	- Resets Wiring System 1
Exec Reset Wiring System 2 -		 Resets Wiring System 2 Not displayed when the analysis mode is set to Wiring1
Exec Reset Wiring System 182		Resets Wiring System 1 and 2 Not displayed when the analysis mode is set to Wiring1

Harmonic Analysis (Harmonics)

The following settings (which are used when analyzing harmonics) are explained.

- Harmonic analysis mode
- · Harmonic analysis items
- · Harmonic analysis window

Setting the Harmonic Analysis Mode (Harmonic)

Press the Harmonic soft key to display the following screen.

· When Analysis Mode is set to Line RMS

	Set the e 8kHz, 4kH	dge source Hz, 2kHz, 1	e filter (OFF, 12 kHz, 500Hz, 25	8kHz, 64kHz, 32kHz, 16kHz, 0Hz, 125Hz, 62.5Hz).	
	Set ti	Set the hysteresis (/√ , / ↓, /).			
	Se	elect the m	ath source way	veform.	
		Set the	analysis mode	(OFF, Line RMS, Power).	
Harmonic Configuration (Out	put(H:Slot8()	H15/CH16))	Harmonic Config		
Analysis Mode	Line RMS				
Source	CI I1				
Calc Period			Harmonic Analycic		
Edge Source	CI 11		Item	 Select the harmonic analysis items. 	
Hysteresis 🥢	#	≠			
Edge Source Filter	OFF				
Φ Scale Ra	adian De	egree			
	Selec	t the φ sca	le.		

When Analysis Mode is set to Power

Select the math source waveform.



Detail Setting (Detail)

Press **Setup...** to display the following screen.

-Calc Period-	armonic Detail Setup
Edge Source	
Hysteresis	₩ # #
Edge Source Filter	OFF
Φ Scale	Radian Degree

Select the edge detection source (U1, I1, Other Channel).

Set the hysteresis (/√, /∕∕, <u>/∕∕</u>).

Set the edge source filter (OFF, 128kHz, 64kHz, 32kHz, 16kHz, 8kHz, 4kHz, 2kHz, 1kHz, 500Hz, 250Hz, 125Hz, 62.5Hz).

Set the φ scale (Radian, Degree).

Selecting Harmonic Analysis Items (Harmonic Analysis Item)

Press the Harmonic Analysis Item soft key to display the following screen.

Display example when the analysis mode is set to Power and the wiring system is set to 1P2W

115							
	Harmonic A	nalysis Item				Analysis Item	
√ P(3)	□P(4)	✓P(5)	□P(6)	√ P(7)	□P(8)		1
✓P(11)	□P(12)	✓P(13)	□P(14)	✓P(15)	□P(16)		
✓P(19)	□P(20)	✓P(21)	□P(22)	✓P(23)	□P(24)		
✓P(27)	□P(28)	✓P(29)	□P(30)	✓P(31)	□P(32)	1	
✓P(35)							1
□Phdf(3)	□Phdf(4)	□Phdf(5)	□Phdf(6)	□Phdf(7)	□Phdf(8)		
□Phdf(11)	□Phdf(12)	□Phdf(13)	□Phdf(14)	□Phdf(15)	□Phdf(16)		
□Phdf(19)	□Phdf(20)	□Phdf(21)	□Phdf(22)	□Phdf(23)	□Phdf(24)		
□Phdf(27)	□Phdf(28)	□Phdf(29)	□Phdf(30)	□Phdf(31)	□Phdf(32)		
□Phdf(35)						All Output Items -	 Set all output items.
 	□Φ(4)	□\$\phi(5)	□\$(6)	□ Φ(7)	□ Φ(8)	Setup	
□ Φ(11)	□\$\[0\$(12)]	□\$\$\overlime\$	□•(14)	□\$\$\phi\$\$\$	□ Φ(16)	1	See "CH Menu" later
□ Φ(19)	□ Φ(20)	□ Φ(21)	□ Φ(22)	□ Φ(23)	□ Φ(24)	1í	in this section.
□ Φ(27)	□ Φ(28)	□ Φ(29)	□ \[\[\ \ \ \ \ \ \ \ \ \ \ \ \	□ Φ(31)	□ Φ(32)		
□ Φ(35)							
N 0	Øλ					l	_
	-					1	
Phdf(x) JFF							-
	F S S S S S S S S S S S S	Resets se et all ou et P(1 to et Phdf(δet φ(1 to et all out et P(1 to et Phdf(ettings to tput iten 0 35) to C 1 to 35) to C 0 35) to C tput iten 0 35) to C 1 to 35) t	o their dens to OFI DFF. to OFF. DFF. DFF. DS to ON DN. to ON.	efaults. ⁻ (clear ti (select ti	he check boxe he check boxe	s). s).
		Harmonic A	Harmonic Analysis Item	Harmonic Analysis Item ●P(3) ○P(4) ●P(5) ○P(6) ●P(11) ○P(12) ●P(21) ○P(22) ●P(27) ○P(28) ●P(29) ○P(30) ●P(4) ●Phdf(3) ○Phdf(5) ○Phdf(6) ○Phdf(1) ○Phdf(1) ○Phdf(2) ○Phdf(2) ○Phdf(1) ○Phdf(12) ○Phdf(2) ○Phdf(2) ○Phdf(7) ○Phdf(20) ○Phdf(20) ○Phdf(20) ○Phdf(7) ○Phdf(20) ○Phdf(20) ○Phdf(30) ○Phdf(7) ○Phdf(20) ○Phdf(20) ○Phdf(20) ○Phdf(7) ○Phdf(20) ○Phdf(20) ○Phdf(20) ○Phdf(7) ○Phdf(20) ○Phdf(3) ○O(14) ○Phdf(20) ○P(21) ○O(22) ○O(20) ○O(35) ○ ○ ○(30) ○O(35) ○ ○ ○(30) ○O(35) ○ ○ ○ ●Phdf(1) ○ ○ ○ ●Phdf(1) ○ ○ ●Phdf(1)	Harmonic Analysis Item ●P(3) P(4) ●P(5) ●P(6) ●P(7) ●P(11) P(12) ●P(13) ●P(14) ●P(15) ●P(7) ●P(23) ●P(23) ●P(23) ●P(23) ●P(7) ○P(23) ●P(23) ●P(23) ●P(23) ●P(7) ○P(23) ●P(23) ●P(23) ●P(23) ●P(7) ○P(7) ○P(7) ○P(7) ○P(7) ○P(7) ○Phdf(12) ○Phdf(12) ○Phdf(23) ○Phdf(23) ○Phdf(23) ○Phdf(7) ○Phdf(7) ○Phdf(7) ○Phdf(7) ○Phdf(7) ○Phdf(7) ○Phdf(23) ○Phdf(1) ○Phdf(23) ○Phdf(23) ○Phdf(7) ○Phdf(23) ○Phdf(1) ○Phdf(23) ○Phdf(1) ○Phdf(7) ○Phdf(23) ○Phdf(1) ○Phdf(23) ○Phdf(23) ○Phdf(7) ○Phdf(23) ○Phdf(23) ○Phdf(3) ○Phdf(3) ○Phdf(7) ○Phdf(23) ○Phdf(3) ○Phdf(3) ○Phdf(3) ○Phdf(7) ○Phdf(23) ○Phdf(3) ○Phdf(3) ○Phdf(3) ○Phdf(7) ○Phdf(2) <td>Harmonic Analysis Item Image: Prior of the stress of the stress</td> <td>Harmonic Analysis Item Analysis Item ●P(3) P(4) ●P(5) P(6) ●P(7) P(8) ●P(11) P(12) ●P(13) P(14) ●P(7) P(8) ●P(2) P(2) ●P(2) ●P(2) P(2) P(16) ●P(7) P(2) ●P(2) ●P(2) P(2) P(2) ●P(2) ●P(2) ●P(2) ●P(2) P(2) ●P(7) P(4) ●P(7) P(4) ●P(7) ●P(7) P(7) P(7) P(7) P(7) ●P(7) ●P(7) P(7) P(7) P(7) ●P(7) ●P(7) ●P(7) ●P(7) ●P(7) ●P(7) ●P(7</td>	Harmonic Analysis Item Image: Prior of the stress	Harmonic Analysis Item Analysis Item ●P(3) P(4) ●P(5) P(6) ●P(7) P(8) ●P(11) P(12) ●P(13) P(14) ●P(7) P(8) ●P(2) P(2) ●P(2) ●P(2) P(2) P(16) ●P(7) P(2) ●P(2) ●P(2) P(2) P(2) ●P(2) ●P(2) ●P(2) ●P(2) P(2) ●P(7) P(4) ●P(7) P(4) ●P(7) ●P(7) P(7) P(7) P(7) P(7) ●P(7) ●P(7) P(7) P(7) P(7) ●P(7) ●P(7) ●P(7) ●P(7) ●P(7) ●P(7) ●P(7

Harmonic Analysis Window Setup (Harmonic Window Setup)

There are three methods to display the harmonic analysis results.

- Bar: A bar graph is displayed for the calculated harmonic value of each harmonic up to the 40th harmonic.
- Vector: The relationship of the phase difference and size (rms value) between the fundamental waves U(1) and I(1) of the element is displayed with vectors.
- List: A numerical list is displayed for the calculated harmonic value of each harmonic up to the 40th harmonic.

Bar

Press the Harmonic Window Setup soft key and then Bar to display the following menu.

(Window Setup)]
Graph Window	Select the graph window (OEE Bar List Vector)
Bar	Select the graph white (OFF, Bar, List, Vector).
🗟 Display Item	Sat the diaplay item (D. hdf. a)
P/hdf/0	- Set the display item (P, hdi, φ).
Display May Order	Sat the maximum harmonic to diaplay (using the isa shuttle)
	Set the maximum harmonic to display (using the Jog shuttle)
V Scale	Select the vertical cools
Linear Log	(Linear, Log).
🐵 Graph Position	
0.00 <mark>0</mark> div	Set the graph position (using the jog shuttle).
Next 1/2	Displays the second page of the menu

Press the **Next** soft key to display the second page of the menu.



4 Configuring the Power Math Feature

List

Press the Harmonic Window Setup soft key and then List to display the following menu.

Window Setup]
Graph Window	-Select the graph window (OFF, Bar, List, Vector).
List	
🛚 Display Item 🗋	Set the display item (P. hdf. (a)
P/hdf/Φ	Set the display item (r, nui, ψ).
Display Max Order	- Set the maximum harmonic to display (using the jog shuttle).
List Start Order	- Set the starting harmonic to list (using the iog shuttle).
🗟 Graph Position	Cot the smark modifier (using the ise shuttle)
0.00 <mark>0</mark> div	- Set the graph position (using the jog shuttle).
Ì	
•	
Next 1/2	Displays the second page of the menu

Press the **Next** soft key to display the second page of the menu.

j
Select the main screen ratio (50% 20% 0%)
Select the screen layout (Side, Vertical).

Vector

Press the Harmonic Window Setup soft key and then Vector to display the following menu.

Window Setup Graph Window Vector] – Select the graph window (OFF, Bar, List, Vector).
Numeric OFF ON U:Zoom X 1 S I:Zoom X 1	 Turns the numeric display on or off Set the zoom position (using the jog shuttle).
Graph Position	- Set the graph position (using the jog shuttle).
₩ Next 1/2 -	Displays the second page of the menu

Press the **Next** soft key to display the second page of the menu.

(Window_Setup	
Main Ratio	Select the main screen ratio (50% 20% 0%)
50%	
Window Layout	Salast the series layout (Side Martinel)
Side	Select the screen layout (Side, vertical).
Next 2/2	

CH Menu

Press a key from CH13 to CH16. The following menu appears.

CH13 and CH14 are power analysis channels. CH15 and CH16 are harmonic analysis channels.



Note.

When power analysis or harmonic analysis is enabled, CH13 to CH16 are fixed to ON, even if you press any of these keys.

All Output Items Setup (All Output Items Setup)

Press the All Output Items Setup soft key to display the following screen.



Setup screen for power analysis

Use the jog shuttle to move the cursor to the item you want to set.

• Setup screen for harmonic analysis

	All Output Items Setup								Setup		
		Analysis Item		Label	V/DIV	DIV/ Scale	Offset	Position	V Zoom		
1	+	RMS(x)			1.000 V	DIV	V00.0	0.00div	x 1		
2	+	Rhdf(x)			1.000 %	DIV	0.00%	0.00div	x 1	\vdash	
3	\pm)	Φ(x)			1.000 deg	DIV	0.00deg	0.00div	x 1		
4	М.	RMS		RMS	1.000 V	DIV	0.00V	0.000	x 1		
5		THDIEC		THDIEC	1.000 %	DIV	0.00%	0.00div	x 1		
6		THDCSA		THDCSA	1.000 %	DIV	0.00%	0.00div	x 1		1
	+										
	+									Í	1
	+										
	+										
	+		-								J
	+										
	+++									All Output Items	Ontimizes the
	+++		-							Optimize Value/Div	Optimizes the
	+		-								Value/Div settings
	+++		-								of all items
	+++		-								
	+		-								
	+++		-								J
	tit								_		
_	_										1

Use the jog shuttle to move the cursor to the item you want to set.

Move the cursor to "-" and press SET to display the items that have been set to ON when harmonic analysis items were selected.

						All Output Ite	em
				Analysis Item	Label	V/DIV	
			+	RMS(x)		1.000 V	
	1	2	+	Rhdf(x)		1.000 %	
	1.1	3	E	Ф(х)		1.000 deg	
	C	1		¢(1)	PHI(1)	1.000 deg	
	Ę	5		¢(2)	PHI(2)	1.000 deg	
	E	ò		Φ(3)	PHI(3)	1.000 deg	
t		7		¢(4)	PHI(4)	1.000 deg	
	8	3		Φ(5)	PHI(5)	1.000 deg	
	3	3		Φ(6)	PHI(6)	1.000 deg	
	1	0		¢(7)	PHI(7)	1.000 deg	
	L 1	1		φ(8)	PHI(8)	1.000 deg	

Displays the items that have been set to ON

Commands

List of Commands

5

Command	Function	Page
ANALysis Group		
:ANALysis <x>?</x>	Queries all power math (power analysis or harmonic analysis) settings.	5-9
:ANALysis <x>:HARMonic?</x>	Queries harmonic analysis setting of the power math feature.	5-9
:ANALysis <x>:HARMonic:GRAPh?</x>	Queries all settings related to the harmonic analysis result display.	5-9
:ANALysis <x>:HARMonic:GRAPh:DIT em?</x>	Queries all analysis items settings of the harmonic analysis result display.	5-9
:ANALysis <x>:HARMonic:GRAPh:DIT</x>	Sets or queries whether percentage content (HDF) is displayed in the	5-9
·ANALysis<>>·HARMonic·GRAPh·DIT	Sats or queries whather active power (P) is displayed in the harmonic	5_0
em:P	analysis result display	5-5
:ANALysis <x>:HARMonic:GRAPh:DIT</x>	Sets or queries whether phase angle (ϕ) is displayed in the harmonic	5-9
em:PHI	analysis result display.	00
:ANALvsis <x>:HARMonic:GRAPh:DIT</x>	Sets or queries whether rms values (RMS) is displayed in the harmonic	5-9
em:RMS	analysis result display.	
:ANALysis <x>:HARMonic:GRAPh:LST</x>	Sets or queries whether list starting harmonic is displayed in the harmonic analysis result display (window settings)	5-10
:ANALysis <x>:HARMonic:GRAPh:MAX</x>	Sets or queries the maximum displayed harmonic in the harmonic analysis	5-10
order	result display (window settings).	0.0
:ANALysis <x>:HARMonic:GRAPh:MO</x>	Sets or queries the graph mode in the harmonic analysis result display	5-10
DE	(window settings).	
:ANALysis <x>:HARMonic:GRAPh:NUM</x>	Sets or gueries whether numeric string is displayed when the graph mode is	5-10
eric	set to Vector in the harmonic analysis result display (window settings).	
:ANALysis <x>:HARMonic:GRAPh:POS</x>	Sets or queries the graph position in the harmonic analysis result display	5-10
ition	(window settings).	
:ANALysis <x>:HARMonic:GRAPh:SCA Le</x>	Sets or queries the vertical scale when the graph mode is set to Bar in the harmonic analysis result display (window settings).	5-10
:ANALvsis <x>:HARMonic:GRAPh:IZO</x>	Sets or queries the current zoom when the graph mode is set to Vector in the	5-10
om	harmonic analysis result display (window settings).	
:ANALysis <x>:HARMonic:GRAPh:UZO</x>	Sets or gueries the voltage zoom when the graph mode is set to Vector in	5-11
om	the harmonic analysis result display (window settings).	
:ANALysis <x>:HARMonic:MODE</x>	Sets or queries the analysis mode in harmonic analysis settings.	5-11
:ANALysis <x>:HARMonic:POWer:<pa< td=""><td>Sets or queries the label of an analysis item in harmonic analysis (for Power</td><td>5-11</td></pa<></x>	Sets or queries the label of an analysis item in harmonic analysis (for Power	5-11
rameter 1>:LABel	mode).	
:ANALysis <x>:HARMonic:POWer:<pa< td=""><td>Sets or queries the offset of an analysis item in harmonic analysis (for Power</td><td>5-11</td></pa<></x>	Sets or queries the offset of an analysis item in harmonic analysis (for Power	5-11
rameter 1>:OFFSet	mode).	
:ANALysis <x>:HARMonic:POWer:<pa< td=""><td>Optimizes Value/Div of an analysis item in harmonic analysis (for Power</td><td>5-11</td></pa<></x>	Optimizes Value/Div of an analysis item in harmonic analysis (for Power	5-11
rameter 1>:OPTimize	mode).	
:ANALysis <x>:HARMonic:POWer:<pa< td=""><td>Sets or queries the position of an analysis item in harmonic analysis (for Power mode)</td><td>5-12</td></pa<></x>	Sets or queries the position of an analysis item in harmonic analysis (for Power mode)	5-12
:ANALysis <x>:HARMonic:POWer:<pa< td=""><td>Sets or queries the scale boundaries (upper and lower) of an analysis item in</td><td>5-12</td></pa<></x>	Sets or queries the scale boundaries (upper and lower) of an analysis item in	5-12
rameter 1>:SCALe	harmonic analysis (for Power mode).	5-12
:ANALysis <x>:HARMonic:POWer:<pa rameter 1>:STATe</pa </x>	Sets or queries the on/off status of an analysis item in harmonic analysis (for Power mode).	5-12
:ANALysis <x>:HARMonic:POWer:<pa< td=""><td>Sets or queries the DIV/Scale setting of an analysis item in harmonic</td><td>5-12</td></pa<></x>	Sets or queries the DIV/Scale setting of an analysis item in harmonic	5-12
rameter 1>:VARiable	analysis (for Power mode).	
:ANALysis <x>:HARMonic:POWer:<pa< td=""><td>Sets or gueries the V/DIV setting of an analysis item in harmonic analysis (for</td><td>5-12</td></pa<></x>	Sets or gueries the V/DIV setting of an analysis item in harmonic analysis (for	5-12
rameter 1>:VDIV	Power mode).	
:ANALysis <x>:HARMonic:POWer:<pa< td=""><td>Sets or queries the vertical zoom (V Zoom) of an analysis item in harmonic</td><td>5-13</td></pa<></x>	Sets or queries the vertical zoom (V Zoom) of an analysis item in harmonic	5-13
·ANALWEISCY>·HAPMONIC·DOMOS·CDO	analysis (IVI FUWEI IIIVUE). Sate or quarters the offect of an analysis item (D. Dhaf, and a of all hermonics)	5 1 2
rameter 2>:OFFSet	in harmonic analysis (for Power mode).	5-15
:ANALysis <x>:HARMonic:POWer:<pa< td=""><td>Sets the position of an analysis item (P, Phdf, and φ of all harmonics) in</td><td>5-13</td></pa<></x>	Sets the position of an analysis item (P, Phdf, and φ of all harmonics) in	5-13
ANAL VOI CAN HADMODI C. DOMOTI C. D.	Rathonic analysis (10) Power mode).	5 1 2
.ANALYSIS\X/:HARMONIC:POWer: <pa< td=""><td>oets the scale boundaries (upper and lower) of an analysis item (P, Phot, and (b of all harmonics) in harmonic analysis (for Dowor modo)</td><td>0-13</td></pa<>	oets the scale boundaries (upper and lower) of an analysis item (P, Phot, and (b of all harmonics) in harmonic analysis (for Dowor modo)	0-13
	and φ of an number of the n	

Command	Function	Page
:ANALysis <x>:HARMonic:POWer:<pa< td=""><td>Sets the on/off status of an analysis item (P, Phdf, and ϕ of all harmonics) in</td><td>5-13</td></pa<></x>	Sets the on/off status of an analysis item (P, Phdf, and ϕ of all harmonics) in	5-13
rameter 2>:STATe	harmonic analysis (for Power mode).	
:ANALysis <x>:HARMonic:POWer:<pa< td=""><td>Sets the DIV/Scale setting of an analysis item (P, Phdf, and ϕ of all</td><td>5-13</td></pa<></x>	Sets the DIV/Scale setting of an analysis item (P, Phdf, and ϕ of all	5-13
rameter 2>:VARiable	harmonics) in harmonic analysis (for Power mode).	
:ANALysis <x>:HARMonic:POWer:</x>	Sets the V/DIV setting of an analysis item (P, Phdf, and φ of all harmonics) in	5-14
<pre><parameter 2="">:VDIV</parameter></pre>	harmonic analysis (for Power mode).	F 4 4
:ANALYSIS <x>:HARMonic:POwer:<pa< td=""><td>Sets the vertical zoom (V 200m) of an analysis item (P, Phot, and ϕ of all</td><td>5-14</td></pa<></x>	Sets the vertical zoom (V 200m) of an analysis item (P, Phot, and ϕ of all	5-14
·ANALysisty>·HARMonic·POWer·SOIL	Sets or queries source channel 11 in harmonic analysis (for Power mode)	5_1/
Rce:I1		5-14
:ANALysis <x>:HARMonic:POWer:SOU</x>	Sets or queries source channel I2 in harmonic analysis (for Power mode)	5-14
Rce:12		• • •
:ANALysis <x>:HARMonic:POWer:SOU</x>	Sets or queries source channel I3 in harmonic analysis (for Power mode).	5-14
Rce:I3		
:ANALysis <x>:HARMonic:POWer:SOU</x>	Sets or queries source channel U1 in harmonic analysis (for Power mode).	5-14
Rce:U1		
:ANALysis <x>:HARMonic:POWer:SOU</x>	Sets or queries source channel U2 in harmonic analysis (for Power mode).	5-15
Rce:U2		- 1-
:ANALysis <x>:HARMonic:POWer:SOU</x>	Sets or queries source channel U3 in harmonic analysis (for Power mode).	5-15
·ANALysis(x)·HAPMonic·POWer·TE	Queries all calculation period settings in harmonic analysis (for Power	5-15
RM?	mode)	5-15
:ANALvsis <x>:HARMonic:POWer:TER</x>	Sets or queries the edge source filter for the calculation period in harmonic	5-15
M:ESFilter	analysis (for Power mode).	0.0
:ANALysis <x>:HARMonic:POWer:TER</x>	Sets or queries the hysteresis for the calculation period in harmonic analysis	5-15
M:HYSTeresis	(for Power mode).	
:ANALysis <x>:HARMonic:POWer:TER</x>	Sets or queries the edge detection source for the calculation period in	5-15
M:ESOurce	harmonic analysis (for Power mode).	
:ANALysis <x>:HARMonic:POWer:WIR</x>	Sets or queries the wiring system in harmonic analysis (for Power mode).	5-16
ing		= 10
:ANALysis <x>:HARMonic:PSCale</x>	Sets or queries the φ (phase difference) scale in harmonic analysis (for Device mode)	5-16
· ANAI weiser V· HAPMonic·IPMS?	Overies all settings related to the harmonic analysis (for Line RMS mode)	5 16
·ANALysis <x>·HARMonic·LRMS·<par< td=""><td>Sets or queries the label of an analysis item in harmonic analysis (for Line</td><td>5-16</td></par<></x>	Sets or queries the label of an analysis item in harmonic analysis (for Line	5-16
ameter 1>:LABel	RMS mode).	5-10
:ANALysis <x>:HARMonic:LRMS:<par< td=""><td>Optimizes Value/Div of an analysis item in harmonic analysis (for Line RMS</td><td>5-16</td></par<></x>	Optimizes Value/Div of an analysis item in harmonic analysis (for Line RMS	5-16
ameter 1>:OPTimize	mode).	
:ANALysis <x>:HARMonic:LRMS:<par< td=""><td>Sets or queries the offset of an analysis item in harmonic analysis (for Line</td><td>5-16</td></par<></x>	Sets or queries the offset of an analysis item in harmonic analysis (for Line	5-16
ameter 1>:OFFSet	RMS mode).	
:ANALysis <x>:HARMonic:LRMS:<par< td=""><td>Sets or queries the position of an analysis item in harmonic analysis (for Line</td><td>5-16</td></par<></x>	Sets or queries the position of an analysis item in harmonic analysis (for Line	5-16
ameter 1>:POSition	RMS mode).	
:ANALysis <x>:HARMonic:LRMS:</x>	Sets or queries the scale boundaries (upper and lower) of an analysis item in	5-17
·NNALucicZVN:HAPMonic:LPMS:	narmonic analysis (for Line RMS mode).	5 17
<pre> ANALySIS / AAAMONIC.LAMS. <parameter 1="">:STATe </parameter></pre>	Line RMS mode)	5-17
:ANALysis <x>:HARMonic:LRMS:</x>	Sets or queries the DIV/Scale setting of an analysis item in harmonic	5-17
<parameter 1="">:VARiable</parameter>	analysis (for Line RMS mode).	•
:ANALysis <x>:HARMonic:LRMS:</x>	Sets or queries the V/DIV setting of an analysis item in harmonic analysis (for	5-17
<parameter 1="">:VDIV</parameter>	Line RMS mode).	
:ANALysis <x>:HARMonic:LRMS:</x>	Sets or queries the vertical zoom (V Zoom) of an analysis item in harmonic	5-17
<parameter 1="">:ZOOM</parameter>	analysis (for Line RMS mode).	
:ANALysis <x>:HARMonic:LRMS:<par< td=""><td>Sets the offset of an analysis item (RMS, Rhdf, and φ of all harmonics) in</td><td>5-18</td></par<></x>	Sets the offset of an analysis item (RMS, Rhdf, and φ of all harmonics) in	5-18
ameter 2>:OFFSet	harmonic analysis (for Line RMS mode).	5.40
:ANALYSIS <x>:HARMONIC:LRMS:<par< td=""><td>Sets the position of an analysis item (RMS, Rhot, and ϕ of all narmonics) in harmonic analysis (for Line RMS mode).</td><td>5-18</td></par<></x>	Sets the position of an analysis item (RMS, Rhot, and ϕ of all narmonics) in harmonic analysis (for Line RMS mode).	5-18
·ANALysisty>·HARMonic·LRMS· <par< td=""><td>Sets the scale boundaries (upper and lower) of an analysis item (RMS_Rhdf</td><td>5-18</td></par<>	Sets the scale boundaries (upper and lower) of an analysis item (RMS_Rhdf	5-18
ameter 2>:SCALe	and ϕ of all harmonics) in harmonic analysis (for Line RMS mode)	0-10
:ANALysis <x>:HARMonic:LRMS:<par< td=""><td>Sets the on/off status of an analysis item (RMS. Rhdf. and φ of all harmonics)</td><td>5-18</td></par<></x>	Sets the on/off status of an analysis item (RMS. Rhdf. and φ of all harmonics)	5-18
ameter 2>:STATe	in harmonic analysis (for Line RMS mode).	
:ANALysis <x>:HARMonic:LRMS:</x>	Sets the DIV/Scale setting of an analysis item (RMS, Rhdf, and ϕ of all	5-18
<parameter 2="">:VARiable</parameter>	harmonics) in harmonic analysis (for Line RMS mode).	
:ANALysis <x>:HARMonic:LRMS:<par< td=""><td>Sets the V/DIV setting of an analysis item (RMS, Rhdf, and ϕ of all</td><td>5-18</td></par<></x>	Sets the V/DIV setting of an analysis item (RMS, Rhdf, and ϕ of all	5-18
ameter 2>:VDIV	harmonics) in harmonic analysis (for Line RMS mode).	

Command	Function	Page
:ANALysis <x>:HARMonic:LRMS:<par ameter 2>:ZOOM</par </x>	Sets the vertical zoom (V Zoom) of an analysis item (RMS, Rhdf, and ϕ of all harmonics) in harmonic analysis (for Line RMS mode).	5-18
:ANALysis <x>:HARMonic:LRMS:SOUR ce</x>	Sets or queries source channel in harmonic analysis (for Line RMS mode).	5-19
:ANALysis <x>:HARMonic:LRMS:TE RM?</x>	Queries all calculation period settings in harmonic analysis (for Line RMS mode).	5-19
:ANALysis <x>:HARMonic:LRMS:TERM :ESFilter</x>	Sets or queries the edge source filter for the calculation period in harmonic analysis (for Line RMS mode).	5-19
:ANALysis <x>:HARMonic:LRMS: TERM:HYSTeresis</x>	Sets or queries the hysteresis for the calculation period in harmonic analysis (for Line RMS mode).	5-19
:ANALysis <x>:MODE</x>	Sets or queries the power math mode.	5-19
:ANALysis <x>:OPTimize</x>	Optimizes Value/Div of all analysis items of power math (power analysis or harmonic analysis).	5-19
:ANALysis <x1>:POWer<x2>?</x2></x1>	Queries all power analysis settings (Wiring System1 or Wiring System2) of power math.	5-19
:ANALysis <x1>:POWer<x2>:EFFicie ncy?</x2></x1>	Queries all efficiency settings of power analysis (Wiring System1 or Wiring System2).	5-19
:ANALysis <x1>:POWer<x2>:EFFicie ncy:MODE</x2></x1>	Sets or queries the efficiency mode of power analysis.	5-20
:ANALysis <x1>:POWer<x2>:EFFicie ncy:MOTor</x2></x1>	Sets or queries the motor efficiency calculation method of power analysis.	5-20
:ANALysis <x1>:POWer<x2>:EFFicie ncy:RANgle</x2></x1>	Sets or queries the rotation angle source for the motor efficiency calculation (rotation angle mode) of power analysis.	5-20
:ANALysis <x1>:POWer<x2>:EFFicie ncy:SCALing</x2></x1>	Sets or queries the scaling for the motor efficiency calculation (rotation angle mode) of power analysis.	5-20
:ANALysis <x1>:POWer<x2>:EFFicie ncy:SPEed</x2></x1>	Sets or queries the rotation speed source for the motor efficiency calculation (rotation speed mode) of power analysis.	5-20
:ANALysis <x1>:POWer<x2>:EFFicie</x2></x1>	Sets or queries the scaling for the motor efficiency calculation (rotation speed mode) of power analysis	5-20
:ANALysis <x1>:POWer<x2>:EFFicie ncy:TORQue</x2></x1>	Sets or queries the torque source for the motor efficiency calculation of power analysis.	5-21
:ANALysis <x1>:POWer<x2>:INTegra tion?</x2></x1>	Queries all integration settings of power analysis.	5-21
:ANALysis <x1>:POWer<x2>:INTegra tion:CALExecute</x2></x1>	Calibrates the integration calculation of power analysis.	5-21
:ANALysis <x1>:POWer<x2>:INTegra tion:CONDition</x2></x1>	Sets or queries the integration condition for the power analysis integration.	5-21
:ANALysis <x1>:POWer<x2>:INTegra tion:MRESet</x2></x1>	Manually resets the integrated value of power analysis.	5-21
:ANALysis <x1>:POWer<x2>:INTegra tion:RCONdition</x2></x1>	Sets or queries whether the integrated value is reset when the power analysis integration starts.	5-21
:ANALysis <x1>:POWer<x2>:INTegra tion:SCALing</x2></x1>	Sets or queries the scaling for the power analysis integration.	5-21
:ANALysis <x1>:POWer<x2>:<parame ter>:{PH1 PH2 PH3 SIGMa}:LABel</parame </x2></x1>	Sets or queries the analysis item power supply analysis label of power analysis.	5-22
:ANALysis <x1>:POWer<x2>:<parame ter>:{PH1 PH2 PH3 SIGMa}:OFFSet</parame </x2></x1>	Sets or queries the offset of an analysis item in power analysis.	5-22
:ANALysis <x1>:POWer<x2>:<parame ter>:{PH1 PH2 PH3 SIGMa}:OPTimi ze</parame </x2></x1>	Optimizes Value/Div of an analysis item in power analysis.	5-23
:ANALysis <x1>:POWer<x2>:<parame ter>:{PH1 PH2 PH3 SIGMa}:POSiti</parame </x2></x1>	Sets or queries the position of an analysis item in power analysis.	5-23
:ANALysis <x1>:POWer<x2>:<parame< td=""><td>Sets or queries the scale boundaries (upper and lower) of an analysis item in</td><td>5-23</td></parame<></x2></x1>	Sets or queries the scale boundaries (upper and lower) of an analysis item in	5-23
:ANALysis <x1>:POWer<x2>:<parame< td=""><td>Sets or queries the on/off status of an analysis item in power analysis.</td><td>5-23</td></parame<></x2></x1>	Sets or queries the on/off status of an analysis item in power analysis.	5-23
:ANALysis <x1>:POWer<x2>:<parame ter>:{PH1 PH2 PH3 SIGMa}:VARiab le</parame </x2></x1>	Sets or queries the DIV/Scale setting of an analysis item in power supply analysis.	5-23
:ANALysis <x1>:POWer<x2>:<parame ter>:{PH1 PH2 PH3 SIGMa}:VDTV</parame </x2></x1>	Sets or queries the V/DIV setting of an analysis item in power analysis.	5-23
:ANALysis <x1>:POWer<x2>:<parame ter>:{PH1 PH2 PH3 SIGMa}:ZOOM</parame </x2></x1>	Sets or queries the vertical zoom (V Zoom) of an analysis item in power analysis.	5-24

Command	Function	Page
:ANALysis <x1>:POWer<x2>:PSCale</x2></x1>	Sets or queries the ϕ (phase difference) scale in power analysis.	5-24
:ANALysis <x1>:POWer<x2>:RTYPe</x2></x1>	Sets or queries the RMS type of an analysis item in power analysis.	5-24
:ANALysis <x1>:POWer<x2>:SOURce :I1</x2></x1>	Sets or queries source channel I1 in power analysis.	5-24
:ANALysis <x1>:POWer<x2>:SOURce :I2</x2></x1>	Sets or queries source channel I2 in power analysis.	5-24
:ANALysis <x1>:POWer<x2>:SOURce :I3</x2></x1>	Sets or queries source channel I3 in power analysis.	5-24
:ANALysis <x1>:POWer<x2>:SOURce :U1</x2></x1>	Sets or queries source channel U1 in power analysis.	5-24
:ANALysis <x1>:POWer<x2>:SOURce :U2</x2></x1>	Sets or queries source channel U2 in power analysis.	5-25
:ANALysis <x1>:POWer<x2>:SOURce :U3</x2></x1>	Sets or queries source channel U3 in power analysis.	5-25
:ANALysis <x1>:POWer<x2>:TERM?</x2></x1>	Queries all calculation period settings of power analysis (Wiring System1 or Wiring System2).	5-25
:ANALysis <x1>:POWer<x2>:TERM:AT IMer</x2></x1>	Sets or queries the update time of the calculation period in power analysis.	5-25
:ANALysis <x1>:POWer<x2>:TERM:ES Filter</x2></x1>	Sets or queries the edge source filter for the calculation period in power analysis.	5-25
:ANALysis <x1>:POWer<x2>:TERM:HY STeresis</x2></x1>	Sets or queries the hysteresis for the calculation period in power analysis.	5-25
:ANALysis <x1>:POWer<x2>:TERM:ES Ource</x2></x1>	Sets or queries the edge detection source channel for the calculation period in power analysis.	5-25
:ANALysis <x1>:POWer<x2>: TERM:STOPpredict</x2></x1>	Sets or queries the stop prediction of the calculation period in power analysis.	5-26
:ANALysis <x1>:POWer<x2>: TERM:TYPE</x2></x1>	Sets or queries the calculation period type in power analysis.	5-26
:ANALysis <x1>:POWer<x2>:TERM:OC Hannel</x2></x1>	Sets or queries the channel number when the edge detection source for the calculation period is set to Other Channel in power analysis.	5-26
:ANALysis <x1>:POWer<x2>:WIRing</x2></x1>	Sets or queries the wiring system in power analysis.	5-26

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:CHANnel <x>:RMATh:AMINus:SCALe</x>	Sets or queries the scale of the specified channel's angle difference	5-27
	operation.	
:CHANnel <x1>:RMATh:ATANgent:SCA</x1>	Sets or queries the scale of the specified channel's arc tangent operation.	5-27
Le		
:CHANnel <x>:RMATh:ATANgent:QUAD</x>	Sets or queries the quadrant range for the arctangent calculation of the	5-27
rant	specified channel.	
:CHANnel <x>:RMATh:AVALue</x>	Sets or queries coefficient A of the currently specified real time math operation.	5-27
:CHANnel <x>:RMATh:BVALue</x>	Sets or queries coefficient B of the currently specified real time math operation.	5-27
:CHANnel <x>:RMATh:BWIDth:BAND</x>	Sets or queries the band of the specified channel's digital filter.	5-27
:CHANnel <x>:RMATh:BWIDth:CFRequ</x>	Sets or queries the center frequency of the bandpass filter of the specified	5-28
ency	channel's digital filter.	
:CHANnel <x>:RMATh:BWIDth:CUToff</x>	Sets or queries the cutoff frequency of the specified channel's digital filter.	5-28
:CHANnel <x>:RMATh:BWIDth:INTer</x>	Sets or queries the interpolation function of the specified channel's digital	5-29
ро	filter.	
:CHANnel <x>:RMATh:BWIDth:MEAN?</x>	Queries all mean settings of the specified channel's digital filter.	5-29
:CHANnel <x>:RMATh:BWIDth:MEAN:S</x>	Sets or queries the sample of the mean of the specified channel's digital filter.	5-29
AMPle (Base Sample)		
:CHANnel <x>:RMATh:BWIDth:MEAN:T</x>	Sets or queries the taps of the mean of the specified channel's digital filter.	5-29
AP		
:CHANnel <x>:RMATh:BWIDth:MODE</x>	Sets or queries the filter mode of the specified channel.	5-29
:CHANnel <x>:RMATh:BWIDth:PBANd</x>	Sets or queries the bandwidth of the bandpass filter of the specified	5-30
(Pass Band)	channel's digital filter.	
:CHANnel <x>:RMATh:BWIDth:TYPE</x>	Sets or queries the digital filter type of the specified channel.	5-30
:CHANnel <x>:RMATh:CANId:BRATe</x>	Sets or queries the CAN ID bit rate of the specified channel.	5-30
(Bit Rate)		
:CHANnel <x>:RMATh:CANId:MFORmat</x>	Sets or queries the CAN ID message format of the specified channel.	5-30
(Message Format)		
:CHANnel <x>:RMATh:CANId:MID</x>	Sets or queries the CAN ID message ID of the specified channel.	5-30
(Message ID)		

CHANDOL (V), PMATTA CANID, SOURCO Sole or quories the CAN ID detection source waveform of the specified	5-30
channel.	0 00
:CHANnel <x>:RMATh:CVALue Sets or queries coefficient C of the currently specified real time math operation.</x>	5-31
:CHANnel <x>:RMATh:DA? Queries all logic signal to analog waveform conversion settings.</x>	5-31
:CHANnel <x>:RMATh:DA:BLENgth Sets or queries the logic signal to analog waveform conversion bit length.</x>	5-31
CHANnel <x1>: RMATh: DA: SOURce Sets or queries the math source waveform that you want to convert into an analog waveform.</x1>	5-31
:CHANnel <x>:RMATh:DA:TYPE Sets or gueries the logic signal to analog waveform conversion method (type).</x>	5-31
:CHANnel <x>:RMATh:DELay Sets or queries the delay of the specified channel.</x>	5-31
:CHANnel <x>:RMATh:DVALue Sets or queries coefficient D of the currently specified real time math operation.</x>	5-31
:CHANnel <x>:RMATh:ECOunt? (Edge Queries all reset condition settings for the specified channel's edge count operation.</x>	5-31
:CHANnel <x>:RMATh:ECOunt:MRESet Resets the counter of the specified channel's edge count operation.</x>	5-32
:CHANnel <x>:RMATh:ECOunt:OVERan Sets or queries whether the edge count is reset when an over limit occurs for the specified channel's edge count operation</x>	5-32
:CHANnel <x>:RMATh:ECOunt:SRESet Sets or queries whether the edge count is reset when the edge count</x>	5-32
(Start Reset) Operation starts for the specified channel.	5-32
operation.	5-02
:CHANNel <x>:RMATh:FREQ? Queries all the settings for the specified channel's frequency, period, torque, and edge count (excluding reset) operations.</x>	5-32
:CHANnel <x>:RMATh:FREQ:BIT Sets or queries the math source waveform (the source bit) for the specified channel's frequency, period, torque, and edge count operations (when the source is a logic channel).</x>	5-32
:CHANnel <x>:RMATh:FREQ:DECelera Sets or queries whether frequency, period, and torque, computation's deceleration prediction is turned on.</x>	5-32
:CHANnel <x>:RMATh:FREQ:HYSTeres Sets or queries the detection hysteresis for the specified channel's frequency, period, torque, and edge count operations.</x>	5-33
:CHANnel <x>:RMATh:FREQ:LEVel Sets or queries the detection level for the specified channel's frequency, period, torque, and edge count operations.</x>	5-33
:CHANnel <x>:RMATh:FREQ:OFFSet Sets or gueries the frequency/period calculation offset.</x>	5-33
:CHANnel <x>:RMATh:FREQ:PROTate Sets or queries the number of pulses per rotation for the specified channel's</x>	5-33
(Pulse per Rotate) frequency operation.	
:CHANnel <x>:RMATh:FREQ:SCALe Sets or queries the scale of the specified channel's frequency operation.</x>	5-33
:CHANnel <x>:RMATh:FREQ:SLOPe Sets or queries the detection slope for the specified channel's frequency, period, torque, and edge count operations.</x>	5-33
:CHANnel <x>:RMATh:FREQ:SOURce Sets or queries the math source waveform for the specified channel's frequency, period, torque, and edge count operations.</x>	5-33
:CHANnel <x>:RMATh:FREQ:STOPpred Sets or queries whether frequency, torque, and period computation's stop</x>	5-33
:CHANnel <x1>:RMATh:IFILter? Queries all IIR filter operation settings</x1>	5-34
:CHANnel <x1>:RMATh:IFILter:BAND Sets or gueries the band of the IIR filter operation.</x1>	5-34
:CHANnel <x1>:RMATh:IFILter:CUTo Sets or queries the cutoff frequency of the IIR filter operation.</x1>	5-34
:CHANnel <x1>:RMATh:IFILter:CFRe Sets or queries the center frequency of the bandpass filter of the IIR filter</x1>	5-34
CHANnel <x1>: RMATh: IFILter: PBA Sets or queries the bandwidth of the bandpass filter of the IIR filter operation.</x1>	5-34
CHANnel <x1>:RMATh:IFILter:INTe Sets or queries whether interpolation is used with the IIR filter operation.</x1>	5-34
:CHANnel <x>:RMATh:INTegral? Queries all integration settings of the specified channel.</x>	5-35
:CHANnel <x>:RMATh:INTegral:MRES Resets the integrated value of the specified channel. et:EXECute (Manual Reset)</x>	5-35
:CHANnel <x>:RMATh:INTegral:OVER Sets or queries whether the integrated value is reset when an over limit</x>	5-35
ange occurs for the specified channel. :CHANnel <x>:RMATh:INTegral:SRES Sets or queries whether the integrated value is reset when integration starts ch_(Chant_React) Sets or queries whether the integrated value is reset when integration starts</x>	5-35
et (start keset) for the specified channel. :CHANnel <x>:RMATh:INTegral:ZRES Queries all settings related to the integrated value being reset when the signal crosses zero in integration of the specified channel.</x>	5-35

Command	Function	Page
:CHANnel <x>:RMATh:INTegral:ZRES</x>	Sets or queries the hysteresis that is used for resetting the integrated value	5-35
et:HYSTeresis	when the signal crosses zero for the specified channel.	
:CHANnel <x>:RMATh:INTegral:ZRES et • MODE</x>	Sets or queries whether the integrated value is reset when the signal crosses zero for the specified channel	5-35
:CHANnel <x>:RMATh:INTegral:ZRES</x>	Sets or queries the slope that is used for resetting the integrated value when	5-35
et:SLOPe	the signal crosses zero for the specified channel.	
:CHANnel <x>:RMATh:KNOCkflt?</x>	Queries all knocking filter settings of the specified channel.	5-36
:CHANnel <x>:RMATh:KNOCkflt:DIFF</x>	Sets or queries the differentiation on/off status of the specified channel's	5-36
erential	knocking filter.	
:CHANNEl <x>:RMATh:KNOCKIIt:ELEV</x>	Sets or queries the elimination level of the specified channel's knocking filter.	5-36
:CHANnel <x>:RMATh:LABel</x>	Sets or queries the label of the specified RMath channel (the specified	5-36
	channel when real time math is turned on).	
:CHANnel <x>:RMATh:MAVG (Moving</x>	Sets or queries the on/off status of the mean of the specified RMath channel	5-36
Average)	(the specified channel when real time math is turned on).	
:CHANnel <x>:RMATh:MODE</x>	Sets or queries the real time math on/off status of the specified channel.	5-36
:CHANnel <x>:RMAIn:OFFSet</x>	Sets or queries the onset of the specified RMath channel (the specified channel when real time math is turned on)	5-36
:CHANnel <x>:RMATh:OPERation</x>	Sets or queries the operation of the specified real time math channel	5-37
:CHANnel <x>:RMATh:OPTimize</x>	Optimizes the vertical scale of the specified channel that will be used in real	5-37
	time math.	
:CHANnel <x>:RMATh:PASub:SIGN</x>	Sets or queries the signs of the sources for the polynomial with a coefficient	5-37
	operation of the specified channel.	F 07
:CHANNEl <x>:RMATN:PINTegral:</x>	Queries all effective power integration settings of the specified channel.	5-37
Set:EXECute	Resets the effective power integration of the specified channel.	5-57
:CHANnel <x>:RMATh:PINTegral:OVE</x>	Sets or queries whether the integrated power value of the specified channel	5-37
Range	is reset when an over limit occurs during effective power integration.	
:CHANnel <x>:RMATh:PINTegral:SCA</x>	Sets the reference time for the effective power integration of the specified	5-37
Le	channel.	
:CHANNEl <x>:RMATH:PINTegral:SRE</x>	Sets or queries whether the integrated value is reset when the effective power integration starts for the specified channel	5-38
:CHANnel <x>:RMATh:POSition</x>	Sets or queries the vertical position of the specified RMath channel (the	5-38
	specified channel when real time math is turned on).	
:CHANnel <x>:RMATh:POWer?</x>	Queries all effective power calculation period settings of the specified	5-38
	channel.	
:CHANNEl <x>:RMATN:POWer:TERM:EB</x>	Sets or queries the effective power calculation period's edge detection math source waveform (detection bit) of the specified channel (when a logic	5-38
11	channel is being used as the edge detection channel).	
:CHANnel <x>:RMATh:POWer:TERM:EH</x>	Sets or queries the effective power calculation period's detection hysteresis	5-38
YSteresis	of the specified channel.	
:CHANnel <x>:RMATh:POWer:TERM:EL</x>	Sets or queries the effective power calculation period's detection level of the	5-38
EVel	specified channel.	E 20
Lope	specified channel	5-30
:CHANnel <x>:RMATh:POWer:TERM:ES</x>	Sets or queries the effective power calculation period's edge detection math	5-39
Ource	source waveform of the specified channel.	
:CHANnel <x1>:RMATh:PWM:PERiod</x1>	Sets or queries the period of the PWM operation.	5-39
:CHANnel <x>:RMATh:RANGle?</x>	Queries all settings related to the angle-of-rotation, electrical angle, sine, and	5-39
·CHANDOL V. PMATh · DANGLO · BI FNG	Cosine operations of the specified channel.	5 30
th	specified channel's angle-of-rotation, electrical angle, sine, and cosine	5-39
	operations.	
:CHANnel <x>:RMATh:RANGle:CCONdi</x>	Sets or queries the resolution for the specified channel's angle-of-rotation,	5-39
tion	electrical angle, sine, and cosine operations.	
(Edge Type)	Sets or queries the encoding type for the specified channel's angle-of-	5-39
:CHANnel <x1>:RMATh:RANGle:HYSTe</x1>	Sets or queries the slope for the specified math source waveform for the	5-40
resis <x2></x2>	specified channel's angle-of-rotation, electrical angle, sine, and cosine	5 10
	operations.	
:CHANnel <x1>:RMATh:RANGle:LEVel</x1>	Sets or queries the detection level for the specified math source waveform	5-40
<x2></x2>	tor the specified channel's angle-of-rotation, electrical angle, sine, and cosine operations	
	operatione.	

Command	Function	Page
:CHANnel <x>:RMATh:RANGle:LOGic?</x>	Queries all the math source waveform settings for the specified channel's angle-of-rotation, electrical angle, sine, and cosine operations.	5-40
:CHANnel <x>:RMATh:RANGle:LOGic: MODE</x>	Sets or queries the math source waveform mode for the specified channel's angle-of-rotation, electrical angle, sine, and cosine operations.	5-40
:CHANnel <x1>:RMATh:RANGle:LOGic :SBIT<x2> (Source BIT)</x2></x1>	Sets or queries the source bit when the math source waveform mode for the specified channel's angle-of-rotation, electrical angle, sine, and cosine operations is logic.	5-40
:CHANnel <x1>:RMATh:RANGle:LOGic :SOURce<x2></x2></x1>	Sets or queries the math source waveform when the math source waveform mode for the specified channel's angle-of-rotation, electrical angle, sine, and cosine operations is logic.	5-41
:CHANnel <x1>:RMATh:RANGle:MRESe t:EXECute</x1>	Resets the angle of the specified channel's angle operations.	5-41
:CHANnel <x>:RMATh:RANGle:NLOGic (Negative Logic)</x>	Sets or queries the on/off status of negative logic in angle operations.	5-41
:CHANnel <x>:RMATh:RANGle:PROTa te (Pulse per Rotate)</x>	Sets or queries the number of pulses per rotation for the specified channel's angle-of-rotation, electrical angle, sine, and cosine operations.	5-41
:CHANnel <x>:RMATh:RANGle:REVer se</x>	Sets or queries whether the rotation direction is inverted for the specified channel's angle-of-rotation, electrical angle, sine, and cosine operations.	5-41
:CHANnel <x1>:RMATh:RANGle:RSOur ce (Resolver Source Ch)</x1>	Sets or queries the math source waveform when the encoding type of the angle-of-rotation, sine, and cosine operations is RESolver.	5-41
:CHANnel <x>:RMATh:RANGle:RTIMi ng (Reset Timing)</x>	Sets or queries the timing that will be used to reset the number of rotations for the specified channel's angle-of-rotation, electrical angle, sine, and cosine operations.	5-42
:CHANnel <x1>:RMATh:RANGle:SCALe</x1>	Sets or queries the scale of the specified channel's angle-of-rotation and electrical angle operations.	5-42
:CHANnel <x>:RMATh:RANGle:SLOGic (Source Logic)</x>	Sets or queries the math source waveform type for the specified channel's angle-of-rotation, electrical angle, sine, and cosine operations.	5-42
:CHANnel <x1>:RMATh:RANGle:SOURc e<x2></x2></x1>	Sets or queries the math source waveform when the math source waveform mode for the specified channel's angle-of-rotation, electrical angle, sine, and cosine operations is not logic.	5-42
:CHANnel <x1>:RMATh:RANGle:TIMin g<x2> (Edge Timing)</x2></x1>	Sets or queries the edge detection timing for the specified channel's angle- of-rotation, electrical angle, sine, and cosine operations.	5-42
:CHANnel <x>:RMATh:RANGle:ZINVe rt</x>	Sets or queries whether the Z phase is inverted for the specified channel's angle-of-rotation, electrical angle, sine, and cosine operations.	5-42
:CHANnel <x1>:RMATh:RESolver?</x1>	Queries all resolver operation settings.	5-42
:CHANnel <x1>:RMATh:RESolver:PHA Se</x1>	Sets or queries the angle combination of 3 phase resolver operation.	5-43
:CHANnel <x1>:RMATh:RESolver:OFF Set</x1>	Sets or queries the offset angle of resolver operation.	5-43
:CHANnel <x1>:RMATh:RESolver:SOU Rce<x2></x2></x1>	Sets or queries the math source waveform of the resolver operation.	5-43
:CHANnel <x1>:RMATh:RESolver:SMO De(Sample Mode)</x1>	Sets or queries the sample mode of the resolver operation.	5-43
:CHANnel <x1>:RMATh:RESolver:HYS Teresis</x1>	Sets or queries the hysteresis of the resolver operation when the sample mode is set to AUTO.	5-43
:CHANnel <x1>:RMATh:RESolver:STI Me(Sampling Time)</x1>	Sets or queries the time from the excitation waveform edge of the resolver operation when the sample mode is set to MANual.	5-43
:CHANnel <x1>:RMATh:RESolver:TFI Lter</x1>	Sets or queries the tracking filter of the resolver operation.	5-44
:CHANnel <x1>:RMATh:RESolver:SCA Le</x1>	Sets or queries the scale of the resolver operation.	5-44
:CHANnel <x>:RMATh:RMS?</x>	Queries all RMS calculation period settings of the specified channel.	5-44
:CHANnel <x>:RMATh:RMS:TERM:EBIT</x>	Sets or queries the edge detection math source waveform (the detection bit) for when the RMS calculation period of the specified channel is set to edge (when a logic channel is being used as the edge detection channel)	5-44
:CHANnel <x>:RMATh:RMS:TERM:EHYS teresis</x>	Sets or queries the detection hysteresis for when the RMS calculation period of the specified channel is set to edge.	5-44
:CHANnel <x>:RMATh:RMS:TERM:ELEV el</x>	Sets or queries the detection level for when the RMS calculation period of the specified channel is set to edge.	5-44
:CHANnel <x>:RMATh:RMS:TERM:ESLo pe</x>	Sets or queries the detection slope for when the RMS calculation period of the specified channel is set to edge.	5-44
:CHANnel <x>:RMATh:RMS:TERM:ESOu rce</x>	Sets or queries the edge detection math source waveform for when the RMS calculation period of the specified channel is set to edge.	5-45

Command	Function	Page
:CHANnel <x>:RMATh:RMS:TERM:MODE</x>	Sets or queries the RMS calculation period mode of the specified channel.	5-45
:CHANnel <x>:RMATh:RMS:TERM:TIME</x>	Sets or queries the interval for when the RMS calculation period of the specified channel is set to time.	5-45
:CHANnel <x>:RMATh:RPOWer:SOURce <x2></x2></x>	Sets or queries the apparent-power, effective-power, voltage, or current channel used to calculate the reactive power of the specified channel.	5-45
:CHANnel <x>:RMATh:RPOWer:VOLTag e:HYSTeresis</x>	Sets or queries the hysteresis of the voltage channel used to calculate the reactive power of the specified channel.	5-45
:CHANnel <x1>:RMATh:SC<x2></x2></x1>	Sets or queries source waveforms 1 to 3 of the currently specified real time math operation.	5-46
:CHANnel <x>:RMATh:SC4</x>	Sets or queries source waveform 4 for the polynomial with a coefficient operation of the specified real time math channel.	5-46
:CHANnel <x>:RMATh:SCALe</x>	Sets or queries the two ends of the scale of the specified RMath channel (the specified channel when real time math is turned on).	5-46
:CHANnel <x1>:RMATh:SQRT1:SIGN</x1>	Sets or queries the sign for the specified channel's square root operation.	5-46
:CHANnel <x>:RMATh:UNIT</x>	Sets or queries the unit string of the specified RMath channel (the specified channel when real time math is turned on).	5-46
:CHANnel <x>:RMATh:VARiable</x>	Sets or queries the vertical scale setup method of the specified RMath channel (the specified channel when real time math is turned on).	5-46
:CHANnel <x>:RMATh:VDIV</x>	Sets or queries the value/div setting of the specified RMath channel (the specified channel when real time math is turned on).	5-46
:CHANnel <x>:RMATh:ZOOM</x>	Sets or queries the vertical zoom factor of the specified RMath channel (the specified channel when real time math is turned on).	5-47

The commands in this group deal with power math. You can perform the same operations and make the same settings and queries that you can make by pressing ANALYSIS on the front panel or by accessing the menus for channels RMATh13 to RMATh16.

:ANALys	is <x>?</x>	:ANALys	is <x>:HARMonic:GRAPh:DITem:P</x>
Function	Queries all power math (power analysis or	Function	Sets or queries whether active power (P) is
	harmonic analysis) settings.		displayed in the harmonic analysis result display.
Syntax	:ANALysis <x>?</x>	Syntax	:ANALysis <x>:HARMonic:GRAPh:DITem:P</x>
	<x> = 1 or 2</x>		{ <boolean>}</boolean>
	When <x> = 1: All power analysis settings</x>		:ANALysis <x>:HARMonic:GRAPh:DITem:P?</x>
	When <x> = 2: All harmonic analysis settings</x>		<x> = 2</x>
Description	This command is valid on models with the /G5	Example	:ANALYSIS2:HARMONIC:GRAPH:DITEM:P 1
	option.		:ANALYSIS2:HARMONIC:GRAPH:DITEM:P?
			-> :ANALYSIS2:HARMONIC:GRAPH:
:ANALys	is <x>:HARMonic?</x>		DITEM:P 1
Function	Queries harmonic analysis setting of the power	Description	This command is valid on models with the /G5
	math feature.		option.
Syntax	:ANALysis <x>:HARMonic?</x>		
	<x> = 2</x>	: ANALys	is <x>:HARMonic:GRAPh:DITem:P</x>
Description	This command is valid on models with the /G5	HI	
	option.	Function	Sets or queries whether phase angle (ϕ) is
			displayed in the harmonic analysis result display.
:ANALys	is <x>:HARMonic:GRAPh?</x>	Syntax	:ANALysis <x>:HARMonic:GRAPh:DITem:P</x>
Function	Queries all settings related to the harmonic	-	HI { <boolean>}</boolean>
	analysis result display.		:ANALysis <x>:HARMonic:GRAPh:DITem:P</x>
Syntax	:ANALysis <x>:HARMonic:GRAPh?</x>		HI?
	<x> = 2</x>		<x> = 2</x>
Description	This command is valid on models with the /G5	Example	:ANALYSIS2:HARMONIC:GRAPH:DITEM:
	option.		PHI 1
			:ANALYSIS2:HARMONIC:GRAPH:DITEM:PHI?
: ANALvs	is <x>:HARMonic:GRAPh:DITem?</x>		-> :ANALYSIS2:HARMONIC:GRAPH:DITEM:P
Function	Queries all analysis items settings of the		HI 1
	harmonic analysis result display.	Description	This command is valid on models with the /G5
Svntax	:ANALysis <x>:HARMonic:GRAPh:DITem?</x>		option.
Description	This command is valid on models with the /G5		
	option.	· ANAT.vs	is <x> HARMonic · GRAPh · DITem · R</x>
		MS	
· ANALws	is <v> HARMonic · GRAPh · DITem · H</v>	Function	Sets or queries whether rms values (RMS) is
.mmys	15 (x) immunomic Given m. Direm m		displayed in the harmonic analysis result display
Function	Sets or queries whether percentage content	Syntax	:ANALysis <x>:HARMonic:GRAPh:DTTem:R</x>
1 dilotion	(HDE) is displayed in the harmonic analysis result	Cyntax	MS { <boolean>}</boolean>
	display		·ANALysis <x>·HARMonic·GRAPh·DITem·R</x>
Syntax	·ANALysis <x>·HARMonic·GRAPh·DITem·H</x>		MS?
Oyntax	DF { <boolean>}</boolean>		<v> = 2</v>
	·ANALysis<>>>HARMonic·GRAPh·DITem·H	Example	·ANALYSIS2·HARMONIC·CRAPH·DITEM·
	DF2	Livampie	RMS 1
	ST = 2		·ANALVSIS2·HARMONIC·CRAPH·DITEM·RMS2
Evampla	·ANALYSTS2·HARMONIC·CRAPH·DITEM·		-> ·ANALYSIS2·HARMONIC·GRAPH·DITEM·R
слатріс	HDF 1		MS 1
	·ANALYSIS2·HARMONIC·CRAPH·DITEM·HDF?	Description	This command is valid on models with the /G5
		Description	ontion
	DE 1		option.
Description	This command is valid on models with the /CE		
Description	ontion		
	option.		

_	1S <x>:HARMONIC:GRAPH:LSTart</x>
Function	Sets or queries whether list starting harmonic is
	displayed in the harmonic analysis result display
	(window settings).
Syntax	:ANALysis <x>:HARMonic:GRAPh:LSTart</x>
	{ <nrf>}</nrf>
	:ANALysis <x>:HARMonic:GRAPh:LSTart?</x>
	<x> = 2</x>
	<nrf> to 1 to 40 (/35) (up to 40 for RMS, up to 35</nrf>
	for Power)
Example	:ANALYSIS2:HARMONIC:GRAPH:LSTART 2
	:ANALYSIS2:HARMONIC:GRAPH:LSTART?
	-> :ANALYSIS2:HARMONIC:GRAPH:
	LSTART 2
Description	This command is valid on models with the /G5
	option.
· ANALus	is <x> HARMonic · CRAPh · MAXorder</x>
Function	Sets or queries the maximum displayed harmonic
1 dilotion	in the harmonic analysis result displayed harmonic
	settings)
Svntax	:ANALvsis <x>:HARMonic:GRAPh:MAXorder</x>
e j'illuit	{ <nrf>}</nrf>
	:ANALysis <x>:HARMonic:GRAPh:MAXord</x>
	er?
	<x> = 2</x>
	<nrf> to 1 to 40 (/35) (up to 40 for RMS, up to 35</nrf>
	for Power)
Example	:ANALYSIS2:HARMONIC:GRAPH:
	MAXORDER 11
	:ANALYSIS2:HARMONIC:GRAPH:MAXORDER?
	-> :ANALYSIS2:HARMONIC:GRAPH:MAXORD
	ER 11
Description	This command is valid on models with the /G5
	option.
	- F
:ANALys	is <x>:HARMonic:GRAPh:MODE</x>
: ANALys Function	is<x>:HARMonic:GRAPh:MODE</x> Sets or queries the graph mode in the harmonic
: ANALys Function	is<x>:HARMonic:GRAPh:MODE</x> Sets or queries the graph mode in the harmonic analysis result display (window settings).
: ANALys Function Syntax	<pre>is<x>:HARMonic:GRAPh:MODE Sets or queries the graph mode in the harmonic analysis result display (window settings). :ANALysis<x>:HARMonic:GRAPh:MODE</x></x></pre>
: ANALys Function Syntax	<pre>is<x>: HARMonic: GRAPh: MODE Sets or queries the graph mode in the harmonic analysis result display (window settings). :ANALysis<x>: HARMonic: GRAPh: MODE {OFF BAR LIST VECTor}</x></x></pre>
: ANALys Function Syntax	<pre>is<x>: HARMonic: GRAPh: MODE Sets or queries the graph mode in the harmonic analysis result display (window settings). :ANALysis<x>: HARMonic: GRAPh: MODE {OFF BAR LIST VECTor} :ANALysis<x>: HARMonic: GRAPh: MODE?</x></x></x></pre>
: ANALys Function Syntax	<pre>is<x>: HARMonic: GRAPh: MODE Sets or queries the graph mode in the harmonic analysis result display (window settings). :ANALysis<x>: HARMonic: GRAPh: MODE {OFF BAR LIST VECTor} :ANALysis<x>: HARMonic: GRAPh: MODE? <x> = 2</x></x></x></x></pre>
: ANALys Function Syntax Example	<pre>is<x>: HARMonic: GRAPh: MODE Sets or queries the graph mode in the harmonic analysis result display (window settings). :ANALysis<x>:HARMonic:GRAPh:MODE {OFF BAR LIST VECTor} :ANALysis<x>:HARMonic:GRAPh:MODE? <x> = 2 :ANALYSIS2:HARMONIC:GRAPH:MODE BAR</x></x></x></x></pre>
: ANALys Function Syntax Example	<pre>is<x>:HARMonic:GRAPh:MODE Sets or queries the graph mode in the harmonic analysis result display (window settings). :ANALysis<x>:HARMonic:GRAPh:MODE {OFF BAR LIST VECTor} :ANALysis<x>:HARMonic:GRAPh:MODE? <xx> = 2 :ANALYSIS2:HARMONIC:GRAPH:MODE BAR :ANALYSIS2:HARMONIC:GRAPH:MODE?</xx></x></x></x></pre>
: ANALys Function Syntax Example	<pre>is<x>:HARMonic:GRAPh:MODE Sets or queries the graph mode in the harmonic analysis result display (window settings). :ANALysis<x>:HARMonic:GRAPh:MODE {OFF BAR LIST VECTor} :ANALysis<x>:HARMonic:GRAPh:MODE? <<x> = 2 :ANALYSIS2:HARMONIC:GRAPH:MODE? -> :ANALYSIS2:HARMONIC:GRAPH:MODE?</x></x></x></x></pre>
: ANALys Function Syntax Example	<pre>is<x>:HARMonic:GRAPh:MODE Sets or queries the graph mode in the harmonic analysis result display (window settings). :ANALysis<x>:HARMonic:GRAPh:MODE {OFF BAR LIST VECTor} :ANALysis<x>:HARMonic:GRAPh:MODE? <xx> = 2 :ANALYSIS2:HARMONIC:GRAPH:MODE? -> :ANALYSIS2:HARMONIC:GRAPH:MODE? MODE BAR</xx></x></x></x></pre>
: ANALys Function Syntax Example Description	<pre>is<x>:HARMonic:GRAPh:MODE Sets or queries the graph mode in the harmonic analysis result display (window settings). :ANALysis<x>:HARMonic:GRAPh:MODE {OFF BAR LIST VECTor} :ANALysis<x>:HARMonic:GRAPh:MODE? <<x>= 2 :ANALYSIS2:HARMONIC:GRAPH:MODE? -> :ANALYSIS2:HARMONIC:GRAPH:MODE? -> :ANALYSIS2:HARMONIC:GRAPH:MODE? MODE BAR This command is valid on models with the /G5</x></x></x></x></pre>
: ANALys Function Syntax Example Description	<pre>is<x>:HARMonic:GRAPh:MODE Sets or queries the graph mode in the harmonic analysis result display (window settings). :ANALysis<x>:HARMonic:GRAPh:MODE {OFF BAR LIST VECTor} :ANALysis<x>:HARMonic:GRAPh:MODE? <x> = 2 :ANALYSIS2:HARMONIC:GRAPH:MODE BAR :ANALYSIS2:HARMONIC:GRAPH:MODE? -> :ANALYSIS2:HARMONIC:GRAPH:MODE? MODE BAR This command is valid on models with the /G5 option.</x></x></x></x></pre>
: ANALys Function Syntax Example Description	<pre>is<x>:HARMonic:GRAPh:MODE Sets or queries the graph mode in the harmonic analysis result display (window settings). :ANALysis<x>:HARMonic:GRAPh:MODE {OFF BAR LIST VECTor} :ANALysis<x>:HARMonic:GRAPh:MODE? <x>=2 :ANALYSIS2:HARMONIC:GRAPH:MODE BAR :ANALYSIS2:HARMONIC:GRAPH:MODE? -> :ANALYSIS2:HARMONIC:GRAPH:MODE? MODE BAR This command is valid on models with the /G5 option.</x></x></x></x></pre>
: ANALys Function Syntax Example Description : ANALys	<pre>is<x>:HARMonic:GRAPh:MODE Sets or queries the graph mode in the harmonic analysis result display (window settings). :ANALysis<x>:HARMonic:GRAPh:MODE {OFF BAR LIST VECTor} :ANALysis<x>:HARMonic:GRAPh:MODE? <x> = 2 :ANALYSIS2:HARMONIC:GRAPH:MODE BAR :ANALYSIS2:HARMONIC:GRAPH:MODE? -> :ANALYSIS2:HARMONIC:GRAPH: MODE BAR This command is valid on models with the /G5 option. is<x>:HARMONIC:GRAPh:NUMeric</x></x></x></x></x></pre>
: ANALys Function Syntax Example Description : ANALys Function	<pre>is<x>:HARMonic:GRAPh:MODE Sets or queries the graph mode in the harmonic analysis result display (window settings). :ANALysis<x>:HARMonic:GRAPh:MODE {OFF BAR LIST VECTor} :ANALysis<x>:HARMonic:GRAPh:MODE? <x> = 2 :ANALYSIS2:HARMONIC:GRAPH:MODE BAR :ANALYSIS2:HARMONIC:GRAPH:MODE? -> :ANALYSIS2:HARMONIC:GRAPH: MODE BAR This command is valid on models with the /G5 option. is<x>:HARMONIC:GRAPh:NUMeric Sets or queries whether numeric string is</x></x></x></x></x></pre>
: ANALys Function Syntax Example Description : ANALys Function	<pre>is<x>:HARMonic:GRAPh:MODE Sets or queries the graph mode in the harmonic analysis result display (window settings). :ANALysis<x>:HARMonic:GRAPh:MODE {OFF BAR LIST VECTor} :ANALysis<x>:HARMonic:GRAPh:MODE? <xx 2<br="" =="">:ANALYSIS2:HARMONIC:GRAPH:MODE BAR :ANALYSIS2:HARMONIC:GRAPH:MODE? -> :ANALYSIS2:HARMONIC:GRAPH: MODE BAR This command is valid on models with the /G5 option. is<x>:HARMONic:GRAPh:NUMeric Sets or queries whether numeric string is displayed when the graph mode is set to Vector</x></xx></x></x></x></pre>
: ANALys Function Syntax Example Description : ANALys Function	<pre>is<x>:HARMonic:GRAPh:MODE Sets or queries the graph mode in the harmonic analysis result display (window settings). :ANALysis<x>:HARMonic:GRAPh:MODE {OFF BAR LIST VECTor} :ANALysis<x>:HARMonic:GRAPh:MODE? <x> = 2 :ANALYSIS2:HARMONIC:GRAPH:MODE BAR :ANALYSIS2:HARMONIC:GRAPH:MODE? -> :ANALYSIS2:HARMONIC:GRAPH: MODE BAR This command is valid on models with the /G5 option. is<x>:HARMonic:GRAPh:NUMeric Sets or queries whether numeric string is displayed when the graph mode is set to Vector in the harmonic analysis result display (window extinct)</x></x></x></x></x></pre>
: ANALys Function Syntax Example Description : ANALys Function	<pre>is<x>:HARMonic:GRAPh:MODE Sets or queries the graph mode in the harmonic analysis result display (window settings). :ANALysis<x>:HARMonic:GRAPh:MODE {OFF BAR LIST VECTor} :ANALysis<x>:HARMonic:GRAPh:MODE? <x> = 2 :ANALYSIS2:HARMONIC:GRAPH:MODE BAR :ANALYSIS2:HARMONIC:GRAPH:MODE? -> :ANALYSIS2:HARMONIC:GRAPH:MODE? -> :ANALYSI</x></x></x></x></pre>
: ANALys Function Syntax Example Description : ANALys Function Syntax	<pre>is<x>:HARMonic:GRAPh:MODE Sets or queries the graph mode in the harmonic analysis result display (window settings). :ANALysis<x>:HARMonic:GRAPh:MODE {OFF BAR LIST VECTor} :ANALysis<x>:HARMonic:GRAPh:MODE? <x> = 2 :ANALYSIS2:HARMONIC:GRAPH:MODE BAR :ANALYSIS2:HARMONIC:GRAPH:MODE? -> :ANALYSIS2:HARMONIC:GRAPH:MODE? -> :ANALYSIS2:HARMONIC:GRAPH:MODE? MODE BAR This command is valid on models with the /G5 option. is<x>:HARMOnic:GRAPh:NUMeric Sets or queries whether numeric string is displayed when the graph mode is set to Vector in the harmonic analysis result display (window settings). :ANALysis<x>:HARMonic:GRAPh:NUMeric</x></x></x></x></x></x></pre>
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: ANALys Function Syntax Example Description : ANALys Function Syntax	<pre>is<x>:HARMonic:GRAPh:MODE Sets or queries the graph mode in the harmonic analysis result display (window settings). :ANALysis<x>:HARMonic:GRAPh:MODE {OFF BAR LIST VECTor} :ANALysis<x>:HARMONIC:GRAPh:MODE? <x> = 2 :ANALYSIS2:HARMONIC:GRAPH:MODE BAR :ANALYSIS2:HARMONIC:GRAPH:MODE? -> :ANALYSIS2:HARMONIC:GRAPH:MODE? -> :ANALYSIS2:HARMONIC:GRAPH:MODE? MODE BAR This command is valid on models with the /G5 option. is<x>:HARMONIC:GRAPh:NUMeric Sets or queries whether numeric string is displayed when the graph mode is set to Vector in the harmonic analysis result display (window settings). :ANALysis<x>:HARMonic:GRAPh:NUMeric {<boolean} :ANALysis<x>:HARMonic:GRAPh:NUMeric? <<>> = 2</x></boolean} </x></x></x></x></x></x></pre>
: ANALys Function Syntax Example Description : ANALys Function Syntax	<pre>is<x>:HARMonic:GRAPh:MODE Sets or queries the graph mode in the harmonic analysis result display (window settings). :ANALysis<x>:HARMonic:GRAPh:MODE {OFF BAR LIST VECTor} :ANALysis<x>:HARMonic:GRAPh:MODE? <x>=2 :ANALYSIS2:HARMONIC:GRAPH:MODE BAR :ANALYSIS2:HARMONIC:GRAPH:MODE? -> :ANALYSIS2:HARMONIC:GRAPH:MODE? -> :ANALYSIS2:HARMONIC:GRAPH:MODE? is<x>:HARMonic:GRAPH:MODE? -> :ANALYSIS2:HARMONIC:GRAPH:MODE? -> :ANALYSIS2:HARMONIC:GRAPH:MODE? -> :ANALYSIS2:HARMONIC:GRAPH:MODE? -> :ANALYSIS2:HARMONIC:GRAPH:MODE? -> :ANALYSIS2:HARMONIC:GRAPH:MODE? -> :ANALYSIS2:HARMONIC:GRAPH:MODE? -> :ANALYSIS2:HARMONIC:GRAPH:NUMeric </x></x></x></x></x></pre>
: ANALys Function Syntax Example Description : ANALys Function Syntax Example Description	<pre>is<x>:HARMonic:GRAPh:MODE Sets or queries the graph mode in the harmonic analysis result display (window settings). :ANALysis<x>:HARMonic:GRAPh:MODE {OFF BAR LIST VECTor} :ANALysis<x>:HARMonic:GRAPh:MODE? <x> = 2 :ANALYSIS2:HARMONIC:GRAPH:MODE BAR :ANALYSIS2:HARMONIC:GRAPH:MODE? -> :ANALYSIS2:HARMONIC:GRAPH: MODE BAR This command is valid on models with the /G5 option. is<x>:HARMOnic:GRAPh:NUMeric Sets or queries whether numeric string is displayed when the graph mode is set to Vector in the harmonic analysis result display (window settings). :ANALysis<x>:HARMonic:GRAPh:NUMeric {<boolean} :ANALysis<x>:HARMonic:GRAPh:NUMeric? <x> = 2 This command is valid on models with the /G5</x></x></boolean} </x></x></x></x></x></x></pre>
: ANALys Function Syntax Example Description : ANALys Function Syntax Example Description	<pre>is<x>:HARMonic:GRAPh:MODE Sets or queries the graph mode in the harmonic analysis result display (window settings). :ANALysis<x>:HARMonic:GRAPh:MODE {OFF BAR LIST VECTor} :ANALysis<x>:HARMonic:GRAPh:MODE? <x> = 2 :ANALYSIS2:HARMONIC:GRAPH:MODE BAR :ANALYSIS2:HARMONIC:GRAPH:MODE? -> :ANALYSIS2:HARMONIC:GRAPH: MODE BAR This command is valid on models with the /G5 option. is<x>:HARMonic:GRAPh:NUMeric Sets or queries whether numeric string is displayed when the graph mode is set to Vector in the harmonic analysis result display (window settings). :ANALysis<x>:HARMonic:GRAPh:NUMeric {<boolean} :ANALysis<x>:HARMonic:GRAPh:NUMeric? <x> = 2 This command is valid on models with the /G5 option.</x></x></boolean} </x></x></x></x></x></x></pre>

:ANALysis<x>:HARMonic:GRAPh:POSition

analysis result display (window settings).
:ANALysis<x>:HARMonic:GRAPh:POSition

Sets or queries the graph position in the harmonic

:ANALysis<x>:HARMonic:GRAPh:POSiti

<NRf> = -5 to 5 (in 10 div/display record length

:ANALYSIS2:HARMONIC:GRAPH:POSITION? -> :ANALYSIS2:HARMONIC:GRAPH:POSITI

Sets or queries the vertical scale when the graph mode is set to Bar in the harmonic analysis result

:ANALysis<x>:HARMonic:GRAPh:SCALe

:ANALysis<x>:HARMonic:GRAPh:SCALe?

:ANALYSIS2:HARMONIC:GRAPH:SCALE? -> :ANALYSIS2:HARMONIC:GRAPH:

Sets or queries the current zoom when the graph mode is set to Vector in the harmonic analysis

:ANALysis<x>:HARMonic:GRAPh:IZOom?

:ANALYSIS2:HARMONIC:GRAPH:IZOOM 1 :ANALYSIS2:HARMONIC:GRAPH:IZOOM? -> :ANALYSIS2:HARMONIC:GRAPH:IZOOM 1

Description This command is valid on models with the /G5

<NRf> = 0.1, 0.111, 0.125, 0.143, 0.167, 0.2, 0.25, 0.33, 0.4, 0.5, 0.556, 0.625, 0.667, 0.714, 0.8, 0.833, 1, 1.11, 1.25, 1.33, 1.43, 1.67, 2, 2.22, 2.5, 3.33, 4, 5, 6.67, 8, 10, 12.5, 16.7, 20, 25, 40, 50,

:ANALYSIS2:HARMONIC:GRAPH:

Description This command is valid on models with the /G5

:ANALysis<x>:HARMonic:GRAPh:SCALe

:ANALYSIS2:HARMONIC:GRAPH:

Description This command is valid on models with the /G5

:ANALysis<x>:HARMonic:GRAPh:IZOom

result display (window settings).

:ANALysis<x>:HARMonic:GRAPh:

display (window settings).

{LINear|LOG}

SCALE LINEAR

SCALE LINEAR

IZOom {NRf}

<x> = 2

100

option.

<x> = 2

option.

Function

Syntax

Example

Function

Syntax

Example

Function

Syntax

Example

{<NRf>}

on? <**x> = 2**

steps)

option.

POSITION -2

ON -2.000000000000

:ANALysis<x>:HARMonic:GRAPh:UZOom

:ANALys	1s <x>:HARMONIC:GRAPh:UZOOM</x>
Function	Sets or queries the voltage zoom when the graph
	mode is set to Vector in the harmonic analysis
	result display (window settings).
Syntax	:ANALysis <x>:HARMonic:GRAPh:</x>
	UZOom {NRf}
	:ANALysis <x>:HARMonic:GRAPh:UZOom?</x>
	<x> = 2</x>
	<nrf> = 0.1, 0.111, 0.125, 0.143, 0.167, 0.2, 0.25,</nrf>
	0.33, 0.4, 0.5, 0.556, 0.625, 0.667, 0.714, 0.8,
	0.833, 1, 1.11, 1.25, 1.33, 1.43, 1.67, 2, 2.22, 2.5,
	3.33, 4, 5, 6.67, 8, 10, 12.5, 16.7, 20, 25, 40, 50,
	100
Example	:ANALYSIS2:HARMONIC:GRAPH:UZOOM 1
	:ANALYSIS2:HARMONIC:GRAPH:UZOOM? ->
	:ANALYSIS2:HARMONIC:GRAPH:UZOOM 1
Description	This command is valid on models with the /G5
·	option.
:ANALvs	is <x>:HARMonic:MODE</x>
Function	Sets or queries the analysis mode in harmonic
	analysis settings.
Syntax	:ANALysis <x>:HARMonic:MODE</x>
,	{POWer LRMS}
	:ANALysis <x>:HARMonic:MODE?</x>
	<x> = 2</x>
Example	:ANALYSIS2:HARMONIC:MODE LRMS
	:ANALYSIS2:HARMONIC:MODE?
	-> :ANALYSIS2:HARMONIC:MODE LRMS
Description	This command is valid on models with the /G5
	option.
·ANALus	is <x> HARMonic POWer < Paramet</x>
er 1>:L	ABel
Function	Sets or queries the label of an analysis item in
	harmonic analysis (for Power mode).
Svntax	:ANALysis <x>:HARMonic:POWer:<paramet< td=""></paramet<></x>
-)	er 1>:LABel { <string>}</string>
	:ANALysis <x>:HARMonic:POWer:<paramet< td=""></paramet<></x>
	er 1>:LABel?
	<x> = 2</x>
	<string> = Up to 16 characters</string>
Example	:ANALYSTS2:HARMONIC: POWER: PHDFK5: LAB
Example	EI. "Phdf (5) "
	·ANALYSTS2·HARMONIC·POWER·PHDFK5·LAB
	FL2 -> ·ANALYSIS2·HARMONIC·POWER·PHD
	FK5.LABEL "Phdf(5)"
Description	For the analysis items see "Darameter 1 list "
Description	This command is valid on models with the IC5
	option
	opuon.

<Parameter 1> list

When analysis mode is set to Power

<Parameter>

<pre>>F al allielel ></pre>		
PK <x></x>	Active power	<x>1 to 35</x>
PHDFK <x></x>	Active power percentage content	<x>1 to 35</x>
PHIK <x></x>	Phase angle	<x>1 to 35</x>
Р	Total active powers	
S	Total reactive powers	
Q	Total apparent powers	
LAMBda	Power factor	
URMS <x></x>	1st harmonic rms voltage	<x>1 to 3</x>
	(for displaying vectors)	
IRMS <x></x>	1st harmonic rms current	<x>1 to 3</x>
	(for displaying vectors)	
PHI_U1U <x></x>	1st harmonic voltage phase angle	<x>1 to 3</x>
	(for displaying vectors)	
PHI_U1I <x></x>	1st harmonic current phase angle	<x>1 to 3</x>
	(for displaying vectors)	

:ANALysis<x>:HARMonic:POWer:<Paramet er 1>:OFFSet Function Sets or queries the offset of an analysis item in

T UNCLION	Sets of queries the onset of all analysis item in
	harmonic analysis (for Power mode).
Syntax	:ANALysis <x>:HARMonic:POWer:<paramet< th=""></paramet<></x>
	er 1>:OFFSet { <nrf>}</nrf>
	:ANALysis <x>:HARMonic:POWer:<paramet< th=""></paramet<></x>
	er 1>:OFFSet?
	<x> = 2</x>
	<nrf> = -5.00 to 5.00 (in 0.01 steps)</nrf>
Example	:ANALYSIS2:HARMONIC:POWER:PK1:
	OFFSET -50
	:ANALYSIS2:HARMONIC:POWER:PK1:OFFS
	ET? -> :ANALYSIS2:HARMONIC:POWER:PK1
	:OFFSET -50.0000E+00
Description	• For the analysis items, see "Parameter 1 list."
	• This command is valid on models with the /G5
	option.
	This command is valid when DIV/Scale is set
	to DIV.
:ANALys	<pre>is<x>:HARMonic:POWer:<paramet< pre=""></paramet<></x></pre>
er 1>:0	PTimize
Function	Optimizes Value/Div of an analysis item in
	harmonic analysis (for Power mode).
Syntax	:ANALysis <x>:HARMonic:POWer:<paramet< th=""></paramet<></x>
	er 1>:OPTimize
	<x> = 2</x>
Description	• For the analysis items, see "Parameter 1 list."
	• This command is valid on models with the /G5
	option.

:ANALys	is <x>:HARMonic:POWer:<paramet< th=""><th></th></paramet<></x>	
Function	Sets or queries the position of an analysis item in	
Svntax	:ANALvsis <x>:HARMonic:POWer:<paramet< td=""><td></td></paramet<></x>	
-)	er 1>:POSition { <nrf>}</nrf>	
	:ANALysis <x>:HARMonic:POWer:<paramet< td=""><td></td></paramet<></x>	
	er 1>:POSition?	
	< x > = 2	
Example	<pre><nrt> = -5.00 to 5.00 (In 0.01 steps) .avai vets2.wapmontc.power.pv1.postmt</nrt></pre>	
Example	ON 1	
	:ANALYSIS2:HARMONIC:POWER:PK1:POSITI	
	ON? -> :ANALYSIS2:HARMONIC:POWER:PKI	
Description	For the analysis items, see "Parameter 1 list."	
Decemption	• This command is valid on models with the /G5	
	This command is valid when DIV/Scale is set	
	to DIV.	
:ANALys er 1>:S	is <x>:HARMonic:POWer:<paramet CALe</paramet </x>	
Function	Sets or queries the scale boundaries (upper and	
	lower) of an analysis item in harmonic analysis (for	
_	Power mode).	
Syntax	:ANALysis <x>:HARMonic:POWer:<paramet< td=""><td></td></paramet<></x>	
	<pre>er I>:SCALE {<nri>,<nri>} .aNaLusis<x>.HaRMonic.POWer.<paramet< pre=""></paramet<></x></nri></nri></pre>	
	er 1>:SCALe?	
	<x> = 2</x>	
	<nrf> = -9.9999E+30 to +9.9999E+30</nrf>	
Example	:ANALYSIS2:HARMONIC:POWER:PK1:	
	SCALE 400,0	
	:ANALYSIS2:HARMONIC:POWER:PK1:SCALE?	
	LE 400 000E+00.0 00000E+00	
Description	For the analysis items, see "Parameter 1 list."	
	• This command is valid on models with the /G5	
	This command is valid when DIV/Scale is set	
	to SPAN.	
:ANALys er 1>:S	is <x>:HARMonic:POWer:<paramet TATe</paramet </x>	
Function	Sets or queries the on/off status of an analysis	
	item in harmonic analysis (for Power mode).	
Syntax	:ANALysis <x>:HARMonic:POWer:<paramet< td=""><td></td></paramet<></x>	
	er 1>:STATe { <boolean>}</boolean>	
	:ANALysis <x>:HARMonic:POWer:<paramet< td=""><td></td></paramet<></x>	
	er 1>:STATe?	
	<x> = 1</x>	
Example	:ANALYSIS2:HARMONIC:POWER:PK1:	
	STATE 1	
	:ANALISIS2:HARMONIC:POWER:PK1:STATE?	
	-> :ANALISISZ:HARMONIC:POWER:PKI:STA	
Description	For the analysis items, see "Darameter 1 list "	
Description	This command is valid on models with the /G5	
	option.	

. ANALYS	is <x>:HARMonic:POWer:<paramet< th=""></paramet<></x>
er 1>:V	ARiable
Function	Sets or queries the DIV/Scale setting of an
	analysis item in harmonic analysis (for Power
	mode).
Syntax	:ANALysis <x>:HARMonic:POWer:<paramet< td=""></paramet<></x>
	er 1>:VARiable { <boolean>}</boolean>
	:ANALysis <x>:HARMonic:POWer:<paramet< td=""></paramet<></x>
	er 1>:VARiable?
	<x> = 2</x>
	On : SPAN Off : VDIV
Example	:ANALYSIS2:HARMONIC:POWER:PK1:VARIAB
	LE 1
	:ANALYSIS2:HARMONIC:POWER:PK1:VARIAB
	LE? -> :ANALYSIS2:HARMONIC:POWER:PK1
	:VARIABLE 1
Description	• For the analysis items, see "Parameter 1 list."
	• This command is valid on models with the /G5
	option.
:ANALys	is <x>:HARMonic:POWer:<paramet< td=""></paramet<></x>
.	
er 1>:V	VIU
er 1>:V Function	DIV Sets or queries the V/DIV setting of an analysis
er 1>:V Function	DIV Sets or queries the V/DIV setting of an analysis item in harmonic analysis (for Power mode).
er 1>:V Function Syntax	DIV Sets or queries the V/DIV setting of an analysis item in harmonic analysis (for Power mode). :ANALysis <x>:HARMonic:POWer:<paramet< td=""></paramet<></x>
er 1>:V Function Syntax	DIV Sets or queries the V/DIV setting of an analysis item in harmonic analysis (for Power mode). :ANALysis <x>:HARMonic:POWer:<paramet er 1>:VDIV {<nrf>}</nrf></paramet </x>
er 1>:V Function Syntax	DIV Sets or queries the V/DIV setting of an analysis item in harmonic analysis (for Power mode). :ANALysis <x>:HARMonic:POWer:<paramet er 1>:VDIV {<nrf>} :ANALysis<x>:HARMonic:POWer:<paramet< td=""></paramet<></x></nrf></paramet </x>
er 1>:V Function Syntax	DIV Sets or queries the V/DIV setting of an analysis item in harmonic analysis (for Power mode). :ANALysis <x>:HARMonic:POWer:<paramet er 1>:VDIV {<nrf>} :ANALysis<x>:HARMonic:POWer:<paramet er 1>:VDIV?</paramet </x></nrf></paramet </x>
er 1>:V Function Syntax	<pre>DIV Sets or queries the V/DIV setting of an analysis item in harmonic analysis (for Power mode). :ANALysis<x>:HARMonic:POWer:<paramet er 1>:VDIV {<nrf>} :ANALysis<x>:HARMonic:POWer:<paramet er 1>:VDIV? <x> = 2</x></paramet </x></nrf></paramet </x></pre>
er 1>:V Function Syntax	<pre>DIV Sets or queries the V/DIV setting of an analysis item in harmonic analysis (for Power mode). :ANALysis<x>:HARMonic:POWer:<paramet 1="" er="">:VDIV {<nrf>} :ANALysis<x>:HARMonic:POWer:<paramet 1="" er="">:VDIV? <x> = 2 <nrf> = 1e-20 to 5e20</nrf></x></paramet></x></nrf></paramet></x></pre>
er 1>:V Function Syntax Example	<pre>DIV Sets or queries the V/DIV setting of an analysis item in harmonic analysis (for Power mode). :ANALysis<x>:HARMonic:POWer:<paramet 1="" er="">:VDIV {<nrf>} :ANALysis<x>:HARMonic:POWer:<paramet 1="" er="">:VDIV? <x> = 2 <nrf> = 1e-20 to 5e20 :ANALYSIS2:HARMONIC:POWER:PK1:</nrf></x></paramet></x></nrf></paramet></x></pre>
er 1>:V Function Syntax Example	<pre>DIV Sets or queries the V/DIV setting of an analysis item in harmonic analysis (for Power mode). :ANALysis<x>:HARMonic:POWer:<paramet er 1>:VDIV {<nrf>} :ANALysis<x>:HARMonic:POWer:<paramet er 1>:VDIV? <x> = 2 <nrf> = 1e-20 to 5e20 :ANALYSIS2:HARMONIC:POWER:PK1: VDIV 100</nrf></x></paramet </x></nrf></paramet </x></pre>
er 1>:V Function Syntax Example	<pre>DIV Sets or queries the V/DIV setting of an analysis item in harmonic analysis (for Power mode). :ANALysis<x>:HARMonic:POWer:<paramet er 1>:VDIV {<nrf>} :ANALysis<x>:HARMonic:POWer:<paramet er 1>:VDIV? <x> = 2 <nrf> = 1e-20 to 5e20 :ANALYSIS2:HARMONIC:POWER:PK1: VDIV 100 :ANALYSIS2:HARMONIC:POWER:PK1:VDIV?</nrf></x></paramet </x></nrf></paramet </x></pre>
er 1>:V Function Syntax Example	<pre>DIV Sets or queries the V/DIV setting of an analysis item in harmonic analysis (for Power mode). :ANALysis<x>:HARMonic:POWer:<paramet er 1>:VDIV {<nrf>} :ANALysis<x>:HARMonic:POWer:<paramet er 1>:VDIV? <x> = 2 <nrf> = 1e-20 to 5e20 :ANALYSIS2:HARMONIC:POWER:PK1: VDIV 100 :ANALYSIS2:HARMONIC:POWER:PK1:VDIV? -> :ANALYSIS2:HARMONIC:POWER:PK1:VD</nrf></x></paramet </x></nrf></paramet </x></pre>
er 1>:V Function Syntax Example	<pre>DIV Sets or queries the V/DIV setting of an analysis item in harmonic analysis (for Power mode). :ANALysis<x>:HARMonic:POWer:<paramet er 1>:VDIV {<nrf>} :ANALysis<x>:HARMonic:POWer:<paramet er 1>:VDIV? <x> = 2 <nrf> = 1e-20 to 5e20 :ANALYSIS2:HARMONIC:POWER:PK1: VDIV 100 :ANALYSIS2:HARMONIC:POWER:PK1:VDIV? -> :ANALYSIS2:HARMONIC:POWER:PK1:VD IV 100</nrf></x></paramet </x></nrf></paramet </x></pre>
er 1>:V Function Syntax Example Description	<pre>DIV Sets or queries the V/DIV setting of an analysis item in harmonic analysis (for Power mode). :ANALysis<x>:HARMonic:POWer:<paramet er 1>:VDIV {<nrf>} :ANALysis<x>:HARMonic:POWer:<paramet er 1>:VDIV? <x> = 2 <nrf> = 1e-20 to 5e20 :ANALYSIS2:HARMONIC:POWER:PK1: VDIV 100 :ANALYSIS2:HARMONIC:POWER:PK1:VDIV? -> :ANALYSIS2:HARMONIC:POWER:PK1:VDIV? IV 100 • For the analysis items, see "Parameter 1 list."</nrf></x></paramet </x></nrf></paramet </x></pre>
er 1>:V Function Syntax Example Description	<pre>DIV Sets or queries the V/DIV setting of an analysis item in harmonic analysis (for Power mode). :ANALysis<x>:HARMonic:POWer:<paramet er 1>:VDIV {<nrf>} :ANALysis<x>:HARMonic:POWer:<paramet er 1>:VDIV? <x> = 2 <nrf> = 1e-20 to 5e20 :ANALYSIS2:HARMONIC:POWER:PK1: VDIV 100 :ANALYSIS2:HARMONIC:POWER:PK1:VDIV? -> :ANALYSIS2:HARMONIC:POWER:PK1:VDIV? IV 100 • For the analysis items, see "Parameter 1 list."</nrf></x></paramet </x></nrf></paramet </x></pre>
er 1>:V Function Syntax Example Description	<pre>DIV Sets or queries the V/DIV setting of an analysis item in harmonic analysis (for Power mode). :ANALysis<x>:HARMonic:POWer:<paramet er 1>:VDIV {<nrf>} :ANALysis<x>:HARMonic:POWer:<paramet er 1>:VDIV? <x> = 2 <nrf> = 1e-20 to 5e20 :ANALYSIS2:HARMONIC:POWER:PK1: VDIV 100 :ANALYSIS2:HARMONIC:POWER:PK1:VDIV? -> :ANALYSIS2:HARMONIC:POWER:PK1:VDIV? IV 100 • For the analysis items, see "Parameter 1 list." • This command is valid on models with the /G5 option.</nrf></x></paramet </x></nrf></paramet </x></pre>

:ANALysis <x>:HARMonic:POWer:<paramet< th=""><th colspan="3">:ANALysis<x>:HARMonic:POWer:<paramet< th=""></paramet<></x></th></paramet<></x>		:ANALysis <x>:HARMonic:POWer:<paramet< th=""></paramet<></x>		
er 1>:2	ZOOM	er 2>:1	POSition	
Function	Sets or queries the vertical zoom (V Zoom) of	Function	Sets the position of an analysis item (P, Phdf,	
	an analysis item in harmonic analysis (for Power		and $\boldsymbol{\phi}$ of all harmonics) in harmonic analysis (for	
	mode).		Power mode).	
Syntax	:ANALysis <x>:HARMonic:POWer:<paramet< td=""><td>Syntax</td><td>:ANALysis<x>:HARMonic:POWer:<paramet< td=""></paramet<></x></td></paramet<></x>	Syntax	:ANALysis <x>:HARMonic:POWer:<paramet< td=""></paramet<></x>	
	er 1>:ZOOM { <nrf>}</nrf>		er 2>:POSition { <nrf>}</nrf>	
	:ANALysis <x>:HARMonic:POWer:<paramet< td=""><td></td><td><x> = 2</x></td></paramet<></x>		<x> = 2</x>	
	er 1>:ZOOM?		<nrt> = -5.00 to 5.00 (in 0.01 div steps)</nrt>	
	<x> = 2</x>	Example	:ANALYSIS2:HARMONIC:POWER:PALL:POSIT	
	<pre><nrf> = 0.1 0.111 0.125 0.143 0.167 0.2 0.25</nrf></pre>	Decerintien	ION 2.0	
		Description	For the analysis items, see Parameter 2 list. This command is valid on models with the (CF)	
	0.833 1 1 11 1 25 1 33 1 43 1 67 2 2 22 2 5		• This continand is valid of models with the 765	
	3 33 4 5 6 67 8 10 12 5 16 7 20 25 40 50		 This command is valid when DIV//Scale is set 	
	100		to DIV	
Evample	· ANALYSIS2·HARMONIC·POWER·PK1·ZOOM 2			
Livample	· ANALYSTS2 · HARMONIC · DOWER · DK1 · ZOOM 2	: ANALys	sis <x>:HARMonic:POWer:<paramet< td=""></paramet<></x>	
	ANALISISZ. HARMONIC, FOWER, FRI. 200M:	er 2>:8	SCALe	
	-> :ANALISIS2:HARMONIC:POWER:PKI:ZO	Function	Sets the scale boundaries (upper and lower) of	
D			an analysis item (P, Phdf, and φ of all harmonics)	
Description	• For the analysis items, see "Parameter 1 list."	Curtov	In narmonic analysis (for Power mode).	
	• This command is valid on models with the /G5	Syntax	:ANALYSIS(X): MARMONIC: FOWEL: (Faramet	
	option.		<pre></pre>	
	I his command is valid when DIV/Scale is set		<nrf> = -9.9999F+30 to +9.9999F+30</nrf>	
	to DIV.	Example	:ANALYSIS2:HARMONIC:POWER:PALL:	
			SCALE 10,-10	
: ANALys	sis <x>:HARMonic:POWer:<paramet< td=""><td>Descriptior</td><td>• For the analysis items, see "Parameter 2 list."</td></paramet<></x>	Descriptior	• For the analysis items, see "Parameter 2 list."	
er 2>:0	DFFSet		• This command is valid on models with the /G5	
Function	Sets or queries the offset of an analysis item		option.	
	(P, Phdf, and ϕ of all harmonics) in harmonic		This command is valid when DIV/Scale is set	
	analysis (for Power mode).		to SPAN.	
Syntax	:ANALysis <x>:HARMonic:POWer:<paramet< td=""><td>: ANALVS</td><td>sis<x>:HARMonic:POWer:<paramet< td=""></paramet<></x></td></paramet<></x>	: ANALVS	sis <x>:HARMonic:POWer:<paramet< td=""></paramet<></x>	
	er 2>:OFFSet { <nrf>}</nrf>	er 2>:9	STATE	
	<x> = 2</x>	Function	Sets the on/off status of an analysis item (P, Phdf,	
Example	:ANALYSIS2:HARMONIC:POWER:PALL:OFFS		and φ of all harmonics) in harmonic analysis (for	
	ET 2.0		Power mode).	
Description	• For the analysis items, see "Parameter 2 list."	Syntax	:ANALysis <x>:HARMonic:POWer:<paramet< td=""></paramet<></x>	
	This command is valid on models with the /G5		er 2>:STATe { <boolean>}</boolean>	
	option.		<x> = 2</x>	
	This command is valid when DIV/Scale is set to DIV/	Example	:ANALYSIS2:HARMONIC:POWER:PALL: STATE 1	
		Descriptior	• For the analysis items, see "Parameter 2 list."	
<paramete< td=""><td>r 2> list</td><td></td><td>• This command is valid on models with the /G5</td></paramete<>	r 2> list		• This command is valid on models with the /G5	
When anal	vsis mode is set to Power		option.	
<paramet< td=""><td>er></td><td>: ANALVS</td><td>sis<x>:HARMonic:POWer:<paramet< td=""></paramet<></x></td></paramet<>	er>	: ANALVS	sis <x>:HARMonic:POWer:<paramet< td=""></paramet<></x>	
PALL	Active power of all harmonics	er 2>:1	VARiable	
PHDFALL	Active power percentage content of all	Function	Sets the DIV/Scale setting of an analysis item	
	harmonics		(P, Phdf, and φ of all harmonics) in harmonic	
PHIALL	Phase angle of all harmonics		analysis (for Power mode)	
		Syntax	:ANALysis <x>:HARMonic:POWer:<paramet< td=""></paramet<></x>	
			er 2>:VARiable { <boolean>}</boolean>	
			<x> = 2</x>	
			On : SPAN Off : VDIV	

Example

BLE 1

option.

÷.

:ANALYSIS2:HARMONIC:POWER:PALL:VARIA

· This command is valid on models with the /G5

Description • For the analysis items, see "Parameter 2 list."

:ANALys <parame< th=""><th>is<x>:HARMonic:POWer: ter 2>:VDIV</x></th></parame<>	is <x>:HARMonic:POWer: ter 2>:VDIV</x>
Function	Sets the V/DIV setting of an analysis item
	(P, Phdf, and ϕ of all harmonics) in harmonic
	analysis (for Power mode).
Syntax	:ANALysis <x>:HARMonic:POWer:<paramet< td=""></paramet<></x>
	er 2>:VDIV { <nrf>}</nrf>
	<x> = 2</x>
	<nrf> = 1e-20 to 5e20</nrf>
Example	:ANALYSIS2:HARMONIC:POWER:PALL:
	VDIV 10.0
Description	 For the analysis items, see "Parameter 2 list."
	This command is valid on models with the /G5 option.
:ANALys	is <x>:HARMonic:POWer:<paramet< td=""></paramet<></x>
	Sets the vertical zoom (\/ Zoom) of an analysis
1 unction	item (P. Phdf, and (a of all harmonics) in harmonic
	analysis (for Power mode)
Syntax	·ANALysis
Oymax	er 2>:ZOOM { <nrf>}</nrf>
	<x> = 2</x>
	<nrt> = 0.1, 0.111, 0.125, 0.143, 0.167, 0.2, 0.25,</nrt>
	0.33, 0.4, 0.5, 0.556, 0.625, 0.667, 0.714, 0.8,
	0.000, 1, 1.11, 1.20, 1.00, 1.40, 1.07, 2, 2.22, 2.0,
	3.33, 4, 5, 6.67, 6, 10, 12.5, 16.7, 20, 25, 40, 50, 100
Example	:ANALYSIS2:HARMONIC:POWER:PALL: ZOOM 2.0
Description	 For the analysis items, see "Parameter 2 list."
	This command is valid on models with the /G5 ontion
	 This command is valid when DIV/Scale is set to DIV/
• ANAT we	is Cr. UAPMonia · DOWOR · SOUDao
:I1	IS X/: MARMONIC: POWEL: SOURCE
Function	Sets or queries source channel I1 in harmonic analysis (for Power mode).
Syntax	:ANALysis <x>:HARMonic:POWer:SOURce :I1 <nrf></nrf></x>
	:ANALysis <x>:HARMonic:POWer:SOURce</x>
	<pre><r>< = 2</r></pre>
	<nrf> = 1 to 16</nrf>
Example	:ANALYSIS2:HARMONIC:POWER:
Example	SOURCE 1 2
	:ANALYSIS2:HARMONIC:POWER:SOURCE:11?
	-> :ANALYSIS2:HARMONIC:POWER:
	SOURCE: 11 2
Description	This command is valid on models with the /G5
200010001	option.

:ANALys :I2	is <x>:HARMonic:POWer:SOURce</x>
Function	Sets or queries source channel I2 in harmonic
	analysis (for Power mode).
Syntax	:ANALysis <x>:HARMonic:POWer:SOURce :I2 <nrf></nrf></x>
	:ANALysis <x>:HARMonic:POWer:SOURce</x>
	:I2?
	<x> = 2</x>
	<nrf> = 1 to 16</nrf>
Example	:ANALYSIS2:HARMONIC:POWER:
	:ANALYSIS2:HARMONIC:POWER:SOURCE:I22
	-> :ANALYSIS2:HARMONIC:POWER:
	SOURCE:12 2
Description	This command is invalid when the wiring
	system is 1P2W.
	This command is valid on models with the /G5
	option.
:ANALys :I3	is <x>:HARMonic:POWer:SOURce</x>
Function	Sets or queries source channel I3 in harmonic
	analysis (for Power mode).
Syntax	:ANALysis <x>:HARMonic:POWer:SOURce</x>
	:13 <nki></nki>
	:13?
	<x> = 2</x>
	<nrf> = 1 to 16</nrf>
Example	:ANALYSIS2:HARMONIC:POWER:
	SOURCE:I3 2
	:ANALYSIS2:HARMONIC:POWER:SOURCE:I3?
	-> :ANALYSIS2:HARMONIC:POWER:
Description	This command is invalid when the
Beschption	wiring system is 1P2W. 1P3W. 3P3W. or
	3P3W→3V3A.
	This command is valid on models with the /G5
	option.
:ANALvs	is <x>:HARMonic:POWer:SOURce</x>
:U1	
Function	Sets or queries source channel U1 in harmonic
_	analysis (for Power mode).
Syntax	:ANALysis <x>:HARMonic:POWer:SOURce</x>
	:UI <nki></nki>
	:U1?
	<x> = 2</x>
	<nrf> = 1 to 16</nrf>
Example	:ANALYSIS2:HARMONIC:POWER:
	SOURCE:U1 1
	:ANALYSIS2:HARMONIC:POWER:SOURCE:U1?
	-> :ANALYSIS2:HARMONIC:POWER:
Description	SOURCE: UI I This command is valid on models with the ICE
	option.
	•

:ANALys	is <x>:HARMonic:POWer:SOURce</x>
:U2	
Function	Sets or queries source channel U2 in harmonic
	analysis (for Power mode).
Syntax	:ANALysis <x>:HARMonic:POWer:</x>
	SOURce:U2 <nrf></nrf>
	:ANALysis <x>:HARMonic:POWer:</x>
	SOURce:U2?
	<x> = 2</x>
	<nrf> = 1 to 16</nrf>
Example	:ANALYSIS2:HARMONIC:POWER:
	SOURCE:U2 1
	:ANALYSIS2:HARMONIC:POWER:SOURCE:U2?
	-> :ANALYSIS2:HARMONIC:POWER:
	SOURCE:U2 1
Description	 This command is invalid when the wiring system is 1P2W.
	This command is valid on models with the /G5
	option.
:ANALys	is <x>:HARMonic:POWer:SOURce</x>
:03	Sate or quarias source channel 113 in harmonic
	analysis (for Dowor mode)
Suntay	ANALUSIS (IN FOWER HOUSE).
Syntax	·U3 <ndf></ndf>
	· ANALysis
	·II32
	Solution
	$\sim x - z$
Example	·ANALVELS2·HADMONIC·DOWED·
схаттріє	SOUDCE-US 1
	- ANALISISZ. HARMONIC. FOWER. SOURCE. US:
	SOURCE-US 1
Description	This command is invalid when the
Description	wiring system is 1P2W 1P3W 3P3W or
	 This command is valid on models with the /G5
	ontion
	option.
. ANAT	i a what was a shower were and
Function	Oueries all calculation period settings in harmonic
1 dilotion	analysis (for Power mode)
Syntax	·ANALysis
Syntax	

	Sets or queries the edge source filter for the
	calculation pariod in harmonic analysis (for Powe
	mode)
Syntax	:ANALysis <x>:HARMonic:POWer:TERM:ESF</x>
-)	<pre>ilter {OFF <frequency>}</frequency></pre>
	:ANALysis <x>:HARMonic:POWer:TERM:ESF</x>
	ilter?
	<x> = 2</x>
	<frequency> = 62.5Hz, 125Hz, 250Hz, 500Hz,</frequency>
	1kHz, 2kHz,4kHz, 8kHz, 16kHz, 32kHz, 64kHz,
	128kHz
Example	:ANALYSIS2:HARMONIC:POWER:TERM:ESFII
	TER 128KHZ
	:ANALYSIS2:HARMONIC:POWER:TERM:ESFII
	TER? -> :ANALYSIS2:HARMONIC:POWER:TE
D	RM:ESFILTER 128E+03
Description	This command is valid on models with the /G5
	option.
· ANAT.ve	is < x> · HARMonic · POWer · TERM · HVS
Teresis	
Function	Sets or queries the hysteresis for the calculation
	period in harmonic analysis (for Power mode).
Syntax	:ANALysis <x>:HARMonic:POWer:TERM:HYS</x>
	Teresis {HIGH LOW MIDDle}
	:ANALysis <x>:HARMonic:POWer:TERM:HYS</x>
	Teresis?
	<x> = 2</x>
Example	:ANALYSIS2:HARMONIC:POWER:TERM:
	HYSTERESIS LOW
	:ANALYSIS2:HARMONIC:POWER:TERM:
	HYSTERESIS? -> :ANALYSIS2:HARMONIC:E
Deceriation	OWER: TERM: HYSTERESIS LOW
1 IDECTINTION	This command is valid on models with the /G5
Description	ontion
Description	option.
: ANAL.VS	option.
:ANALys	option. is <x>:HARMonic:POWer:TERM:ESC</x>
:ANALys urce Function	option. is <x>: HARMonic : POWer : TERM : ESO Sets or queries the edge detection source for the</x>
:ANALys urce Function	option. is <x>: HARMonic : POWer : TERM : ESO Sets or queries the edge detection source for the calculation period in harmonic analysis (for Powe</x>
: ANALys urce Function	option. is <x>: HARMonic: POWer: TERM: ESO Sets or queries the edge detection source for the calculation period in harmonic analysis (for Power mode).</x>
: ANALys urce Function Syntax	option. is <x>:HARMonic:POWer:TERM:ESO Sets or queries the edge detection source for the calculation period in harmonic analysis (for Power mode). :ANALysis<x>:HARMonic:POWer:TERM:ESO</x></x>
: ANALys urce Function Syntax	<pre>option. is<x>:HARMonic:POWer:TERM:ESO Sets or queries the edge detection source for the calculation period in harmonic analysis (for Powe mode). :ANALysis<x>:HARMonic:POWer:TERM:ESO urce {U1 U2 U3 I1 I2 I3}</x></x></pre>
: ANALys urce Function Syntax	<pre>option. is<x>:HARMonic:POWer:TERM:ESO Sets or queries the edge detection source for the calculation period in harmonic analysis (for Power mode). :ANALysis<x>:HARMonic:POWer:TERM:ESO urce {U1 U2 U3 I1 I2 I3} :ANALysis<x>:HARMonic:POWer:TERM:ESO</x></x></x></pre>
: ANALys urce Function Syntax	<pre>option. is<x>:HARMonic:POWer:TERM:ESO Sets or queries the edge detection source for the calculation period in harmonic analysis (for Power mode). :ANALysis<x>:HARMonic:POWer:TERM:ESO urce {U1 U2 U3 I1 I2 I3} :ANALysis<x>:HARMonic:POWer:TERM:ESO urce?</x></x></x></pre>
: ANALys urce Function Syntax	<pre>option. is<x>:HARMonic:POWer:TERM:ESO Sets or queries the edge detection source for the calculation period in harmonic analysis (for Power mode). :ANALysis<x>:HARMonic:POWer:TERM:ESO urce {U1 U2 U3 I1 I2 I3} :ANALysis<x>:HARMonic:POWer:TERM:ESO urce? <x> = 2</x></x></x></x></pre>
: ANALys urce Function Syntax Example	<pre>option. is<x>:HARMonic:POWer:TERM:ESO Sets or queries the edge detection source for the calculation period in harmonic analysis (for Power mode). :ANALysis<x>:HARMonic:POWer:TERM:ESO urce {U1 U2 U3 I1 I2 I3} :ANALysis<x>:HARMonic:POWer:TERM:ESO urce? <x> = 2 :ANALYSIS2:HARMONIC:POWER:TERM:</x></x></x></x></pre>
: ANALys urce Function Syntax Example	<pre>option. is<x>:HARMonic:POWer:TERM:ESO Sets or queries the edge detection source for the calculation period in harmonic analysis (for Power mode). :ANALysis<x>:HARMonic:POWer:TERM:ESO urce {U1 U2 U3 I1 I2 I3} :ANALysis<x>:HARMonic:POWer:TERM:ESO urce? <x> = 2 :ANALYSIS2:HARMONIC:POWER:TERM: ESOURCE U1</x></x></x></x></pre>
: ANALys urce Function Syntax Example	<pre>option. is<x>:HARMonic:POWer:TERM:ESO Sets or queries the edge detection source for the calculation period in harmonic analysis (for Power mode). :ANALysis<x>:HARMonic:POWer:TERM:ESO urce {U1 U2 U3 I1 I2 I3} :ANALysis<x>:HARMonic:POWer:TERM:ESO urce? <x> = 2 :ANALYSIS2:HARMONIC:POWER:TERM: ESOURCE U1 :ANALYSIS2:HARMONIC:POWER:TERM:</x></x></x></x></pre>
: ANALys urce Function Syntax Example	<pre>option. is<x>:HARMonic:POWer:TERM:ESO Sets or queries the edge detection source for the calculation period in harmonic analysis (for Power mode). :ANALysis<x>:HARMonic:POWer:TERM:ESO urce {U1 U2 U3 I1 I2 I3} :ANALysis<x>:HARMonic:POWer:TERM:ESO urce? <x> = 2 :ANALYSIS2:HARMONIC:POWER:TERM: ESOURCE U1 :ANALYSIS2:HARMONIC:POWER:TERM: ESOURCE? -> :ANALYSIS2:HARMONIC:POWER</x></x></x></x></pre>
: ANALys urce Function Syntax Example	<pre>option. is<x>:HARMonic:POWer:TERM:ESO Sets or queries the edge detection source for the calculation period in harmonic analysis (for Power mode). :ANALysis<x>:HARMonic:POWer:TERM:ESO urce {U1 U2 U3 I1 I2 I3} :ANALysis<x>:HARMonic:POWer:TERM:ESO urce? <x> = 2 :ANALYSIS2:HARMONIC:POWER:TERM: ESOURCE U1 :ANALYSIS2:HARMONIC:POWER:TERM: ESOURCE 01 :ANALYSIS2:HARMONIC:POWER:TERM: ESOURCE? -> :ANALYSIS2:HARMONIC:POWER</x></x></x></x></pre>

:ANALys	is <x>:HARMonic:POWer:WIRing</x>
Function	Sets or queries the wiring system in harmonic analysis (for Power mode).
Syntax	:ANALysis <x>:HARMonic:POWer:WIRing {(P1W2 P1W3 P3W3 V3A3 P3W4),(OFF P 3W3_V3A3 DT_ST ST_DT)} <<>>=2</x>
	P1W2 P1W3 P3W3 V3A3 P3W4: wiring system
	selection OFF P3W3_V3A3 DT_ST ST_DT: delta math
Example	<pre>selection :ANALYSIS2:HARMONIC:POWER:WIRING P12W,OFF</pre>
	:ANALYSIS2:HARMONIC:POWER:WIRING? -> :ANALYSIS2:HARMONIC:POWER:WIRING
Description	 Match the wiring system to the conversion source system of delta math.
	This command is valid on models with the /G5 option.
: ANALys Function	is < x >: HARMonic : PSCale Sets or queries the φ (phase difference) scale in harmonic analysis (for Power mode)
Svntax	:ANALvsis <x>:HARMonic:PSCale</x>
-)	{DEGRee RADian}
	:ANALysis <x>:HARMonic:PSCale? <x> = 2</x></x>
Example	:ANALYSIS2:HARMONIC:PSCALE DEGREE
	:ANALYSIS2:HARMONIC:PSCALE?
D	-> :ANALYSIS2:HARMONIC:PSCALE DEGREE
Description	option.
: ANALvs	is <x>:HARMonic:LRMS?</x>
Function	Queries all settings related to the harmonic analysis (for Line RMS mode).
Syntax	:ANALysis <x>:HARMonic:LRMS?</x>
Description	This command is valid on models with the /G5 option.
:ANALys	is <x>:HARMonic:LRMS:<paramet< td=""></paramet<></x>
Function	Sets or queries the label of an analysis item in
	harmonic analysis (for Line RMS mode).
Syntax	:ANALysis <x>:HARMonic:LRMS:<paramet er 1>:LABel {<string>}</string></paramet </x>
	:ANALysis <x>:HARMonic:LRMS:<paramet er 1>:LABel?</paramet </x>
	<x> = 2</x>
Example	<string> = Up to 16 characters :ANALYSIS2:HARMONIC:LRMS:RMSK3:</string>
	LABEL "AAA"
	:ANALYSIS2:HARMONIC:LRMS:RMSK3:LAB EL? -> :ANALYSIS2:HARMONIC:LRMS:RMSK 3:LABEL "AAA"
Description	For the analysis items, see "Parameter 1 list "
	 This command is valid on models with the /G5 option.

<Parameter 1> list

When the analysis mode is Line RMS

<parameter></parameter>		
RMSK <x></x>	RMS Value (RMS)	<x>1 to 40</x>
RHDFK <x></x>	RMS percentage content	<x>1 to 40</x>
PHIK <x></x>	Phase angle	<x>1 to 40</x>
RMS		
THDlec	(Firmware version 3.2 and I	ater)
THDCsa	(Firmware version 3.2 and I	ater)
HDFlec	Same as THDlec	
HDFCsa	Same as THDCsa	

:ANALys	is <x>:HARMonic:LRMS:<paramet< th=""></paramet<></x>
Function	Optimizes Value/Div of an analysis item in harmonic analysis (for Line RMS mode).
Syntax	:ANALysis <x>:HARMonic:LRMS:<paramet er 1>:OPTimize</paramet </x>
Description	<x> = 2 • For the analysis items, see "Parameter 1 list." • This command is valid on models with the /G5 option.</x>
:ANALys er 1>:0	is <x>:HARMonic:LRMS:<paramet FFSet</paramet </x>
Function	Sets or queries the offset of an analysis item in harmonic analysis (for Line RMS mode).
Syntax	:ANALysis <x>:HARMonic:LRMS: <parameter 1="">:OFFSet {<nrf>} :ANALysis<x>:HARMonic:LRMS:<paramet< td=""></paramet<></x></nrf></parameter></x>
	er 1>:OFFSet? <x> = 2</x>
Example	:ANALYSIS2:HARMONIC:LRMS:RMSK3:OFFS ET 1.0
	:ANALYSIS2:HARMONIC:LRMS:RMSK3:OFFS ET? -> :ANALYSIS2:HARMONIC:LRMS:RMSK 3:OFFSET 1.00000E+00
Description	 For the analysis items, see "Parameter 1 list." This command is valid on models with the /G5 option.
	This command is valid when DIV/Scale is set to DIV.
:ANALys er 1>:P	is <x>:HARMonic:LRMS:<paramet OSition</paramet </x>
Function	Sets or queries the position of an analysis item in harmonic analysis (for Line RMS mode).
Syntax	:ANALysis <x>:HARMonic:LRMS:<paramet er 1>:POSition {<nrf>}</nrf></paramet </x>
	:ANALysis <x>:HARMonic:LRMS:<paramet er 1>:POSition? <x> = 2</x></paramet </x>
Example	<pre><nrf> = -5.00 to 5.00 (in 0.01 div steps) :ANALYSIS2:HARMONIC:LRMS:RMSK3:POSIT</nrf></pre>
	<pre>ION -1.2 :ANALYSIS2:HARMONIC:LRMS:RMSK3:POSIT ION? -> :ANALYSIS2:HARMONIC:LRMS:RMS</pre>
Description	 K3:POSITION -1.20 For the analysis items, see "Parameter 1 list." This command is valid on models with the /G5
	option.This command is valid when DIV/Scale is set

to DIV.

: ANALys	sis <x>:HARMonic:LRMS:</x>	: ANA
Function	Sets or queries the scale boundaries (upper and lower) of an analysis item in harmonic analysis (for	Functio
	Line RMS mode).	Syntax
Syntax	:ANALysis <x>:HARMonic:LRMS:</x>	
	<pre> ·Parameter I>:SCALe {<nri>,<nri>} ·ANALysis<x>·HARMonic·LRMS·<paramet <="" pre=""></paramet></x></nri></nri></pre>	
	er 1>:SCALe?	
	<x1> = 2</x1>	
	<nrf> = -9.9999E+30 to +9.9999E+30</nrf>	Evomo
Example	:ANALYSIS2:HARMONIC:LRMS:RMSK3:	Examp
	SCALE 4,0 •ANALYSIS2•HARMONIC•LEMS•EMSK3•SCA	
	LE? -> :ANALYSIS2:HARMONIC:LRMS:RMSK	
	3:SCALE 4.00000E+00,0.00000E+00	
Description	 For the analysis items, see "Parameter 1 list." This command is valid on models with the /G5 	Descrip
	 option. This command is valid when DIV/Scale is set to SPAN 	
	U SFAN.	: ANA
:ANALys	sis <x>:HARMonic:LRMS:</x>	<par< td=""></par<>
<parame< td=""><td>eter 1>:STATe</td><td>Functio</td></parame<>	eter 1>:STATe	Functio
Function	item in harmonic analysis (for Line RMS mode)	
Syntax	:ANALysis <x>:HARMonic:LRMS:<paramet< td=""><td>Syntax</td></paramet<></x>	Syntax
,	er 1>:STATe { <boolean>}</boolean>	Syntax
	:ANALysis <x>:HARMonic:LRMS:<paramet er 1>:STATe?</paramet </x>	
Eveneele	$\langle x \rangle = 2$	
Example	STATE 1	
	:ANALYSIS2:HARMONIC:LRMS:RMSK3:STA	
	TE? -> :ANALYSIS2:HARMONIC:LRMS:RMSK	
	3:STATE 1	
Description	• For the analysis items, see "Parameter 1 list."	
	• This command is valid on models with the /G5 option.	Examp
: ANALys	sis <x>:HARMonic:LRMS:</x>	
<parame< td=""><td>eter 1>:VARiable</td><td></td></parame<>	eter 1>:VARiable	
FUNCTION	analysis item in harmonic analysis (for Line PMS	Descrip
	mode)	
Svntax	:ANALysis <x>:HARMonic:LRMS:<paramet< td=""><td></td></paramet<></x>	
-)	er 1>:VARiable { <boolean>}</boolean>	
	:ANALysis <x>:HARMonic:LRMS:<paramet< td=""><td></td></paramet<></x>	
	er 1>:VARiable?	
	<x> = 2</x>	
	On : SPAN Off : VDIV	
Example	:ANALYSIS2:HARMONIC:LRMS:RMSK3:VARIA BLE 1	
	:ANALYSIS2:HARMONIC:LRMS:RMSK3:	
	VARIABLE? -> :ANALYSIS2:HARMONIC:	
Description	For the analysis items, son "December 1 list."	
Description	This command is valid on models with the /G5	
	option.	
	- p	

:ANALysis <x>:HARMonic:LRMS: <parameter 1="">:VDIV</parameter></x>		
Function	Sets or queries the V/DIV setting of an analysis	
	item in harmonic analysis (for Line RMS mode).	
Syntax	:ANALysis <x>:HARMonic:LRMS:<paramet< td=""></paramet<></x>	
	er 1>:VDIV { <nrf>}</nrf>	
	:ANALysis <x>:HARMonic:LRMS:<paramet< td=""></paramet<></x>	
	er 1>:VDIV?	
	<x> = 2</x>	
	<nrf> = 1e-20 to 5e20</nrf>	
Example	ANALYSIS2:HARMONIC:LRMS:RMSK3:	
Example	VDTV 2	
	·ANALYSIS2:HARMONIC:LRMS:RMSK3:VDIV?	
	-> ·ANALYSTS2·HARMONIC·LEMS·RMSK3·VD	
	TV 2 00000E+00	
Description	For the analysis items, see "Parameter 1 list "	
Description	This command is valid on models with the /CE	
	This command is valid on models with the 7G5	
	option.	
: ANALys	Sis <x>:HARMonic:LRMS:</x>	
<parame< td=""><td>eter 1>: ZOOM</td></parame<>	eter 1>: ZOOM	
Function	Sets or queries the vertical zoom (V Zoom) of an	
	analysis item in harmonic analysis (for Line RMS	
- ·	mode).	
Syntax	:ANALysis <x>:HARMonic:LRMS:<paramet< td=""></paramet<></x>	
	er 1>:ZOOM { <nrf>}</nrf>	
	:ANALysis <x>:HARMonic:LRMS:<paramet< td=""></paramet<></x>	
	er 1>:ZOOM?	
	<x> = 2</x>	
	<nrf> = 0.1, 0.111, 0.125, 0.143, 0.167, 0.2, 0.25,</nrf>	
	0.33, 0.4, 0.5, 0.556, 0.625, 0.667, 0.714, 0.8,	
	0.833, 1, 1.11, 1.25, 1.33, 1.43, 1.67, 2, 2.22, 2.5,	
	3.33, 4, 5, 6.67, 8, 10, 12.5, 16.7, 20, 25, 40, 50,	
	100	
Example	:ANALYSIS2:HARMONIC:LRMS:RMSK3:	
	ZOOM 2	
	:ANALYSIS2:HARMONIC:LRMS:RMSK3:ZOOM?	
	-> :ANALYSIS2:HARMONIC:LRMS:RMSK3:ZO	
	OM 2.000	
Description	• For the analysis items, see "Parameter 1 list."	
	• This command is valid on models with the /G5	
	option.	
	This command is valid when DIV/Scale is set	
	to DIV	

:ANALysis <x>:HARMonic:LRMS:<paramet< th=""></paramet<></x>		
er 2>:0	FFSet	
Function	Sets the offset of an analysis item (RMS, Rhdf,	
	and $(0, 0)$ of all harmonics) in harmonic analysis (for	
	Line RMS mode)	
Suptox	ANAL weight ward of the stand of the second	
Syntax	:ANALySIS <x>:HARMONIC:LRMS:<paramet< td=""></paramet<></x>	
	er 2>:OFFSet { <nri>}</nri>	
	<x> = 2</x>	
Example	:ANALYSIS2:HARMONIC:LRMS:RMSALL:OFFS	
	ET 1.0	
Description	 For the analysis items, see "Parameter 2 list." 	
	 This command is valid on models with the /G5 	
	option	
	option	
<parameter< td=""><td>2> list</td></parameter<>	2> list	
When the a	nalvsis mode is Line RMS	
<paramete< td=""><td>r></td></paramete<>	r>	
PMSALL	PMS values of all harmonics	
RHDEALI	Percentage content of all harmonics	
	Phase angle of all harmonics	
:ANALys	<pre>is<x>:HARMonic:LRMS:<paramet< pre=""></paramet<></x></pre>	
er 2>:P	OSition	
Function	Sets the position of an analysis item (RMS, Rhdf,	
	and $\boldsymbol{\phi}$ of all harmonics) in harmonic analysis (for	
	Line RMS mode).	
Syntax	:ANALysis <x>:HARMonic:LRMS:<paramet< td=""></paramet<></x>	
	er 2>:POSition { <nrf>}</nrf>	
	<x> = 2</x>	
	<nrf> = -5.00 to 5.00 (in 0.01 steps)</nrf>	
Evample		
Livample	TION 1 0	
D	TION 1.0	
Description	For the analysis items, see "Parameter 2 list."	
	 This command is valid on models with the /G5 	
	option.	
	 This command is valid when DIV/Scale is set 	
	to DIV.	
:ANALvs	is <x>:HARMonic:LRMS:<paramet< td=""></paramet<></x>	
er 2>:S	CALe	
Function	Sets the scale boundaries (upper and lower) of an	
1 0.100.011	analysis item (RMS Rhdf and (a of all harmonics)	
	in harmonia analysis (for Line BMS mode)	
Quantaux		
Syntax	:ANALysis <x>:HARMonic:LRMS:</x>	
	<parameter 2="">:SCALe {<nrf>,<nrf>}</nrf></nrf></parameter>	
	<x> = 2</x>	
	<nrf> = -9.9999E+30 to +9.9999E+30</nrf>	
Example	:ANALYSIS2:HARMONIC:LRMS:RMSALL:SCA	
-	LE 10.0,-10.0	
Description	For the analysis items, see "Parameter 2 list "	
	This command is valid on models with the IC5	
	ontion	
	uplion.	
	This command is valid when DIV/Scale is set	
	to SPAN.	

Description •	 For the analysis items, see "Parameter 2 list." This command is valid on models with the /G5 option. This command is valid when DIV/Scale is set to DIV.

:ANALYSIS2:HARMONIC:LRMS:RMSALL:

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TS	Example	:ANALYSIS2:HARMONIC:LRMS:RMSALL:STA
	Description	• For the analysis items, see "Parameter 2 list."
." 65		• This command is valid on models with the /G5 option.
	:ANALys	is <x>:HARMonic:LRMS:</x>
	<parame< td=""><td>ter 2>:VARiable</td></parame<>	ter 2>:VARiable
_	Function	Sets the DIV/Scale setting of an analysis item (RMS, Rhdf, and φ of all harmonics) in harmonic analysis (for Line RMS mode).
-	Syntax	:ANALysis <x>:HARMonic:LRMS:</x>
-	,	<parameter 2:variable="" {<boolean="">}</parameter>
_		<x> = 2</x>
_		On : SPAN Off : VDIV
	Example	:ANALYSIS2:HARMONIC:LRMS:RMSALL:VARI ABLE 1
	Description	• For the analysis items, see "Parameter 2 list."
df,		This command is valid on models with the /G5
or		option.
	:ANALys	is <x>:HARMonic:LRMS:<paramet< td=""></paramet<></x>
	er 2>:V	DIV
	Function	Sets the V/DIV setting of an analysis item
		(RMS, Rhdf, and ϕ of all harmonics) in harmonic
		analysis (for Line RMS mode).
SI	Syntax	:ANALysis <x>:HARMonic:LRMS:<paramet< td=""></paramet<></x>
		er 2>:VDIV { <nrf>}</nrf>
		<x> = 2</x>
5		<nrf> = 1e-20 to 5e20</nrf>
	Example	:ANALYSIS2:HARMONIC:LRMS:RMSALL:
t	Decerintian	VDIV 10.0
	Description	For the analysis items, see Parameter 2 list. This command is valid on models with the //CF
		• This command is valid on models with the 765
		option.
	:ANALys	is <x>:HARMonic:LRMS:<paramet< td=""></paramet<></x>
an	er 2>:Z	OOM
cs)	Function	Sets the vertical zoom (V Zoom) of an analysis
		item (RMS, Rhdf, and ϕ of all harmonics) in
		harmonic analysis (for Line RMS mode).
	Syntax	:ANALysis <x>:HARMonic:LRMS:<paramet< td=""></paramet<></x>
		er 2>:ZOOM { <nrf>}</nrf>
		< x > = 2
4		$\langle NKI \rangle = 0.1, 0.111, 0.125, 0.143, 0.167, 0.2, 0.25, 0.22, 0.4, 0.5, 0.556, 0.625, 0.667, 0.744, 0.0$
		0.33, 0.4, 0.3, 0.330, 0.023, 0.007, 0.714, 0.8,
"		3 33 4 5 6 67 8 10 12 5 16 7 20 25 40 50
5		100

:ANALysis<x>:HARMonic:LRMS:<Paramet

analysis (for Line RMS mode).

:ANALysis<x>:HARMonic:LRMS: <Parameter 2>:STATe {<Boolean>}

Sets the on/off status of an analysis item (RMS, Rhdf, and ϕ of all harmonics) in harmonic

er 2>:STATe

<x> = 2

Function

Syntax

Example

ZOOM 2

5 Commands

:ANALYS	1s <x>:HARMONIC:LRMS:SOURCe</x>
Function	Sets or queries source channel in harmonic
	analysis (for Line RMS mode).
Syntax	:ANALysis <x>:HARMonic:LRMS:SOURce</x>
	{ <nrf>}</nrf>
	:ANALysis <x>:HARMonic:LRMS:SOURce?</x>
	<x> = 2</x>
	<nrf> = 1 to 16</nrf>
Evenale	
Example	:ANALISISZ:HARMONIC:LRMS:SOURCE I
	:ANALYSIS2:HARMONIC:LRMS:SOURCE?
	-> :ANALYSIS2:HARMONIC:LRMS:SOURCE 1
Description	This command is valid on models with the /G5
	option.
:ANALvs	is <x>:HARMonic:LRMS:TERM?</x>
Function	Queries all calculation period settings in harmonic
i unouon	analysis (for Line RMS mode)
Curatavi	
Syntax	:ANALYSIS <x>:HARMONIC:LRMS:TERM?</x>
Description	This command is valid on models with the /G5
	option.
. 3 NIA T	
: ANALYS	1S <x>: HARMONIC: LRMS: TERM: ESF1</x>
lter	Onto an examine the order of the first the
Function	Sets or queries the edge source filter for the
	calculation period in harmonic analysis (for Line
	RMS mode).
Syntax	:ANALysis <x>:HARMonic:LRMS:TERM:ESFi</x>
	<pre>lter {OFF <frequency>}</frequency></pre>
	:ANALysis <x>:HARMonic:LRMS:TERM:ESFi</x>
	lter?
	<x> = 2</x>
	<Erequency > = 62.5Hz 125Hz 250Hz 500Hz
	128KHZ
Example	:ANALYSIS2:HARMONIC:LRMS:TERM:ESFILT
	ER 128KHZ
	:ANALYSIS2:HARMONIC:LRMS:TERM:ESFILT
	ER? -> :ANALYSIS2:HARMONIC:LRMS:TERM
	:ESFILTER 128E+03
Description	This command is valid on models with the /G5
·	option
:ANALys	is <x>:HARMonic:LRMS:</x>
TERM: HY	STeresis
Function	Sets or queries the hysteresis for the calculation
	period in harmonic analysis (for Line RMS mode).
Syntax	:ANALysis <x>:HARMonic:LRMS:</x>
Cyntax	TERM. HVSTorogie (HICHLIOWIMIDDIe)
	:ANALYSIS <x :harmonic:lrms:<="" td=""></x>
	TERM:HISTERESIS?
	<x> = 2</x>
Example	:ANALYSIS2:HARMONIC:LRMS:TERM:HYSTER
	ESIS HIGH
	:ANALYSIS2:HARMONIC:LRMS:TERM:HYSTER
	ESIS? -> :ANALYSIS2:HARMONIC:LRMS:TE
	RM:HYSTERESIS HIGH
Description	This command is valid on models with the /G5
200017001	ontion
	option

:ANALys	is <x>:MODE</x>
Function	Sets or queries the power math mode.
Syntax	:ANALysis <x>:MODE</x>
	{OFF POWer1 POWer2 HARMonic}
	:ANALysis <x>:MODE?</x>
	<x> = 1 or 2</x>
	When $\langle x \rangle = 1$
	OFF: Power analysis is disabled.
	POWer1: Power analysis is set to 1 Wiring
	System mode.
	POWer2: Power analysis is set to 2 Wiring
	Systems mode.
	When $\langle x \rangle = 2$
	OFF: Harmonic analysis is disabled.
	HARMonic: Harmonic analysis is enabled.
Example	:ANALYSIS1:MODE POWER1
	:ANALYSIS1:MODE? -> :ANALYSIS1:
	MODE POWER1
Description	This command is valid on models with the /G5
	option.
:ANALys	is <x>:OPTimize</x>
Function	Optimizes Value/Div of all analysis items of power
	math (power analysis or harmonic analysis).
Syntax	:ANALysis <x>:OPTimize</x>
	<x> = 1 or 2</x>
	When <x> = 1: All analysis items of power</x>
	analysis are optimized.
	When $\langle x \rangle = 2$: All analysis items of harmonic
	analysis are optimized.
Description	This command is valid on models with the /G5
	option.
: ANALYS	Oueries all newer analysis settings (Wiring
T UNCLOT	System1 or Wiring System2) of power math
Suntax	· ANALysis(v1)· POMer(v2)?
Syntax	<pre></pre>
	$x^{2} = 1$ or 2
	$\sqrt{2} = 1012$ When $\langle y^2 \rangle = 1$ Wiring System1 settings
	When $\langle x_2 \rangle = 2$: Wiring System? settings
Description	This command is valid on models with the /G5
Description	ontion
	option.
· ANALus	is < y1 > · DOWar < y2 > · EFFi ciancy2
Function	Queries all efficiency settings of power analysis
	(Wiring System1 or Wiring System2).
Syntax	<x1> = 1 <math><x2> = 1</x2></math> or 2</x1>
- ,	When $\langle x2 \rangle = 1$: All efficiency settings of Wiring
	System1
	When <x2> = 2: All efficiency settings of Wiring</x2>
	System2
Description	This command is valid on models with the /G5
	option.

: ANALys	is <x1>:POWer<x2>:EFFiciency:M</x2></x1>
Function	Sets or queries the efficiency mode of power
Syntax	·ANALysis <v1>·POWer<v2>·EFFiciency·M</v2></v1>
Oyntax	ODE {OFF POWer MOTor}
	:ANALysis <x1>:POWer<x2>:EFFiciency:M</x2></x1>
	ODE?
	<x1> = 1 <x2> = 1 or 2</x2></x1>
Example	:ANALYSIS1:POWER1:EFFICIENCY:
	MODE MOTOR
	:ANALYSIS1:POWER1:EFFICIENCY:MODE?
	-> :ANALYSIS1:POWER1:EFFICIENCY:
Description	MODE MOTOR
Description	This command is valid on models with the /G5
	option.
:ANALys	is <x1>:POWer<x2>:EFFiciency:M</x2></x1>
OTor	
FUNCTION	Sets or queries the motor efficiency calculation
Syntax	·ANALysis
Syntax	OTor {BANGle SPEed}
	:ANALysis <x1>:POWer<x2>:EFFiciency:M</x2></x1>
	OTor?
	<x1> = 1 <x2> = 1 or 2</x2></x1>
	RANGle: Rotation angle
	SPEed: Rotation speed
Example	:ANALYSIS1:POWER1:EFFICIENCY:
	MOTOR RANGLE
	:ANALYSIS1:POWER1:EFFICIENCY:MOTOR?
	-> :ANALYSIS1:POWER1:EFFICIENCY:
Description	This command is valid on models with the /G5
Description	ontion
:ANALys	is <x1>:POWer<x2>:EFFiciency:R</x2></x1>
ANgle	
Function	Sets or queries the rotation angle source for the
	of power analysis.
Syntax	:ANALysis <x1>:POWer<x2>:EFFiciency:R</x2></x1>
	ANgle {RMATh <x3>}</x3>
	:ANALysis <x1>:POWer<x2>:EFFiciency:R</x2></x1>
	ANgle?
Evennle	<x1> = 1 <math><x2> = 1 or 2</x2></math> <math><x3> = 1 to 16</x3></math></x1>
Example	PANCIE DMATHQ
	:ANALYSIS1: POWER1: EFFICIENCY: RANGLE?
	-> :ANALYSIS1:POWER1:EFFICIENCY:RANG
	LE RMATH9
Description	This command is valid on models with the /G5 option
	This key is valid when the Pm type is set to
	rotation angle.

:ANALys	<pre>is<x1>:POWer<x2>:EFFiciency:S</x2></x1></pre>
CALing	-
Function	Sets or queries the scaling for the motor
	efficiency calculation (rotation angle mode) of
	nower analysis
Syntax	·ANALysis <v1>·POWer<v2>·FFFiciency·S</v2></v1>
Oymax	CALing (<nrfs)< td=""></nrfs)<>
	ANAL weigewith Downswith EEE in on our S
	:ANALySIS <xi :efficiency:s<="" :power<x2="" td=""></xi>
	CALING?
	<x1> = 1 <math><x2> = 1</x2></math> or 2</x1>
	<nrt> = -9.999E+30 to +9.9999E+30</nrt>
Example	:ANALYSIS1:POWER1:EFFICIENCY:
	SCALING 3.5
	:ANALYSIS1:POWER1:EFFICIENCY:SCALI
	NG? -> :ANALYSIS1:POWER1:EFFICIENCY:
	SCALING 3.50000E+00
Description	• This command is valid on models with the /G5
	option.
	 This key is valid when the Pm type is set to
	rotation angle.
	5
:ANALys	is <x1>:POWer<x2>:EFFiciency:S</x2></x1>
PEed	
Function	Sets or queries the rotation speed source for the
	motor efficiency calculation (rotation speed mode)
	of power analysis.
Syntax	:ANALysis <x1>:POWer<x2>:EFFiciency:S</x2></x1>
	<pre>PEed {<nrf> RMATh<x3>}</x3></nrf></pre>
	:ANALysis <x1>:POWer<x2>:EFFiciency:S</x2></x1>
	PEed?
	<x1> = 1 <x2> = 1 or 2 <x3> = 1 to 16</x3></x2></x1>
	<nrf> = 1 to 16</nrf>
Example	:ANALYSIS1:POWER1:EFFICIENCY:SPEED 1
	:ANALYSIS1:POWER1:EFFICIENCY:SPEED?
	-> :ANALYSIS1:POWER1:EFFICIENCY:SPE
	ED 1
Description	• This command is valid on models with the /G5
Decemption	ontion
	 This key is valid when the Pm type is set to
	rotation spood
	Totation speed.
:ANALys	<pre>is<x1>:POWer<x2>:EFFiciency:S</x2></x1></pre>
SCaling	(Speed Scaling)
Function	Sets or queries the scaling for the motor
	efficiency calculation (rotation speed mode) of
	power analysis.
Svntax	:ANALysis <x1>:POWer<x2>:EFFiciency:S</x2></x1>
-)	SCale {RPS RPM}
	:ANALysis <x1>:POWer<x2>:EFFiciency:S</x2></x1>
	SCale
	$c_{x1} = 1$ $c_{x2} = 1 \text{ or } 2$
Evennle	
Example	ANALISISI: POWERI: EFFICIENCI:
	SSCALE RPM
	ANALYSISI: POWERI: EFFICIENCY: SSCALE?
	-> ANALYSIS1:POWER1:EFFICIENCY:SSCA
	LE RPM
Description	This command is valid on models with the /G5
	option.

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: ANALys OROue	is <x1>:POWer<x2>:EFFiciency:T</x2></x1>	1
Function	Sets or queries the torque source for the motor efficiency calculation of power analysis.	
Syntax	:ANALysis <x1>:POWer<x2>:EFFiciency:T</x2></x1>	:
	ORQue { <nrf> RMATh<x3>}</x3></nrf>	
	:ANALysis <x1>:POWer<x2>:EFFiciency:T</x2></x1>	
	ORQue?	
	<x1> = 1 <x2> = 1 or 2 <x3> = 1 to 16</x3></x2></x1>	
	<nrf> = 1 to 16</nrf>	
Example	:ANALYSIS1:POWER1:EFFICIENCY:	
	TORQUE RMATH9	
	:ANALYSIS1:POWER1:EFFICIENCY:TORQUE?	j
	-> :ANALYSIS1:POWER1:EFFICIENCY:TORQ	
	UE RMATH9	
Description	This command is valid on models with the /G5 option.	:
:ANALys	is <x1>:POWer<x2>:INTegration?</x2></x1>	
Function	Queries all integration settings of power analysis.	
Syntax	:ANALysis <xl>:POWer<x2>:IN'l'egration?</x2></xl>	
	$\langle x1 \rangle = 1$ $\langle x2 \rangle = 1$ or 2	
	When <x2> = 1: All integration settings of Wiring</x2>	
	Sustem2	
Description	This command is valid on models with the /GF	
Description	option.	
:ANALys	is <x1>:POWer<x2>:INTegration:</x2></x1>	
Eunction	Calibrates the integration calculation of nower	
1 unction	analysis	
Syntax	:ANALysis <x1>:POWer<x2>:INTegration:</x2></x1>	
Oymax	CALExecute	
	<x1> = 1 <math><x2> = 1</x2></math> or 2</x1>	
Example	ANALYSIS1: POWER1: INTEGRATION: CALEXEC	
·	UTE	
Description	This command is valid on models with the /G5	
	option.	
· ANALwa	is <v1>.DOWar<v2>.TNTaration.</v2></v1>	
CONDi+i	on	
Function	Sets or queries the integration condition for the	
	power analysis integration.	
Syntax	:ANALysis <x1>:POWer<x2>:INTegration:</x2></x1>	
,	CONDition {ALLTimes IACQuisition}	
	:ANALysis <x1>:POWer<x2>:INTegration:</x2></x1>	
	CONDition?	
	<x1> = 1 <x2> = 1 or 2</x2></x1>	
	ALLTimes: Integration at all times	
	IACQuisition: Integration only during measurement	
Example	:ANALYSIS1:POWER1:INTEGRATION:	
	CONDITION -> ALLTIMES	
Description	This command is valid on models with the /G5	
	option.	

:ANALys	is <x1>:POWer<x2>:INTegration:</x2></x1>
Eurotion	Manually reports the integrated value of newer
Function	analysis.
Syntax	:ANALysis <x1>:POWer<x2>:INTegration:</x2></x1>
	<pre>MRESet <x1> = 1</x1></pre>
Example	:ANALYSTS1:POWER1:INTEGRATION:MRESET
Description	This command is valid on models with the /G5
Description	ontion
	option.
:ANALys	<pre>is<x1>:POWer<x2>:INTegration: ion</x2></x1></pre>
Function	Sets or queries whether the integrated value is
1 unction	reset when the power analysis integration starts.
Syntax	:ANALysis <x1>:POWer<x2>:INTegration:</x2></x1>
	RCONdition { <boolean>}</boolean>
	:ANALysis <x1>:POWer<x2>:INTegration:</x2></x1>
	RCONdition?
	<x1> = 1 <x2> = 1 or 2</x2></x1>
Example	:ANALYSIS1:POWER1:INTEGRATION:RCONDI
	TION 1
	:ANALYSIS1:POWER1:INTEGRATION:RCONDI
	TION? -> :ANALYSIS1:POWER1:INTEGRATI
	ON:RCONDITION 1
Description	This command is valid on models with the /G5
	option.
• ANAT we	i of w1 \. DOWo rf w2 \. TNmogration.
SCALing	IS XIV. FOWEL XZV. INTEGIACION.
Function	Sets or queries the scaling for the power analysis
	integration.
Syntax	:ANALvsis <x1>:POWer<x2>:INTegration:</x2></x1>
ojnak	SCALing {SECond HOUR}
	:ANALvsis <x1>:POWer<x2>:INTegration:</x2></x1>
	SCALing?
	< x1 > = 1 $< x2 > = 1 or 2$
Example	:ANALYSIS1:POWER1:INTEGRATION:SCALI
Example	NG SECOND
	:ANALYSIS1:POWER1:INTEGRATION:SCALI
	NG? -> :ANALYSIS1:POWER1:INTEGRATION
	:SCALING SECOND
Description	This command is valid on models with the /G5
	option.

:ANALys	is <x1>:POWe</x1>	<pre>c<x2>:<parameter>:</parameter></x2></pre>
{PH1 PH	2 PH3 SIGMa]	:LABel
Function	Sets or queries the	analysis item power supply
	analysis label of po	wer analysis.
Syntax	:ANALysis <x1>:</x1>	POWer <x2>:<parameter></parameter></x2>
	:{PH1 PH2 PH3	<pre>SIGMa}:LABel {<string>}</string></pre>
	:ANALysis <x1>:</x1>	POWer <x2>:<Parameter></x2>
	:{PH1 PH2 PH3	SIGMa}:LABel?
	<x1> = 1 <</x1>	<x2> = 1 or 2</x2>
	<string> = Up to 16</string>	3 characters
Example	:ANALYSIS1:POW	ER1:URMS:PH1:
	LABEL "AAA"	
	:ANALYSIS1:POW	ER1:URMS:PH1:LABEL?
	-> :ANALYSIS1:P	OWER1:URMS:PH1:
	LABEL "AAA"	
Description	• For the analysis	items, see "Parameter list."
	This command is	s valid on models with the /G5

This command is valid on models with the /G5 option.

<Parameter> When the analysis mode is set to 1 Wiring System

URMS	{PH1 PH2 PH3 SIGMa }
IRMS	{PH1 PH2 PH3 SIGMa}
UDC	{PH1 PH2 PH3 SIGMa}
IDC	{PH1 PH2 PH3 SIGMa}
UAC	{PH1 PH2 PH3 SIGMa}
IAC	{PH1 PH2 PH3 SIGMa}
P (Active Power)	{PH1 PH2 PH3 SIGMa}
S (Apparent Power)	{PH1 PH2 PH3 SIGMa}
Q (Reactive Power)	{PH1 PH2 PH3 SIGMa }
LAMBda (Power Factor : λ)	{PH1 PH2 PH3 SIGMa}
PHI (PhaseDifference : Φ)	{PH1 PH2 PH3 SIGMa }
FU	{PH1 PH2 PH3 }
FI	{PH1 PH2 PH3 }
UPPK (U+pk)	{PH1 PH2 PH3 }
UMPK (U-pk)	{ PH1 PH2 PH3 }
IPPK (I+pk)	{ PH1 PH2 PH3 }
IMPK (I-pk)	{ PH1 PH2 PH3 }
PPPK (P+pk)	{ PH1 PH2 PH3 }
PMPK (P-pk)	{ PH1 PH2 PH3 }
WH (WattHours : WP)	{PH1 PH2 PH3 SIGMa }
WHP (WattHours : WP+)	{PH1 PH2 PH3 SIGMa }
WHM (WattHours : WP-)	{PH1 PH2 PH3 SIGMa }
AH (AmpereHours : q)	{PH1 PH2 PH3 SIGMa }
AHP (AmpereHours : q+)	{PH1 PH2 PH3 SIGMa }
AHM (AmpereHours : q-)	{PH1 PH2 PH3 SIGMa }
WS (Volt-ampere hours)	{PH1 PH2 PH3 SIGMa }
WQ (Var hours)	{PH1 PH2 PH3 SIGMa}
Z (Impedance of the load circuit)	{PH1 PH2 PH3 SIGMa }
RS (Series resistance of the load	{ PH1 PH2 PH3 SIGMa }
circuit)	
XS (Series reactance of the load	{ PH1 PH2 PH3 SIGMa }
circuit)	
RP (Parallel resistance of the	{PH1 PH2 PH3 SIGMa }
load circuit)	
XP (Parallel reactance of the	{ PH1 PH2 PH3 SIGMa }
load circuit)	
PM (Motor drive efficiency)	
ETA (Efficiency)	
UUBF (Three-phase voltage	
unbalance factor)	
IUBF (Three-phase current	
unbalance factor)	
IN (Neutral line current)	
TIME (Integration time)	

) ver) /er) Factor λ) rence : Φ)	<pre>{PH1 SIGMa} {PH1 PH2 PH3 }PH1 PH2 PH3 }</pre>
) ver) /er) Factor λ) rence : Φ)	<pre>{PH1 SIGMa} {PH1 PH2 PH3 }PH1 PH2 PH3 }</pre>
) ver) /er) Factor λ) rence : Φ)	<pre>{PH1 SIGMa} {PH1 PH2 PH3 }PH1 PH2 PH3 }</pre>
) ver) /er) Factor λ) rence : Φ)	<pre>{PH1 SIGMa} {PH1 PH2 PH3 }PH1 PH2 PH3 }</pre>
) ver) Factor λ) rence : Φ)	<pre>{PH1 SIGMa} {PH1 PH2 PH3 }PH1 PH2 PH3 }</pre>
) ver) Factor λ) rence : Φ)	<pre>{PH1 SIGMa} {PH1 PH2 PH3 }PH1 PH2 PH3 }</pre>
) ver) /er) Factor λ) rence : Φ)	<pre>{PH1 SIGMa} {PH1 SIGMa} {PH1 SIGMa} {PH1 SIGMa} {PH1 SIGMa} {PH1 PH2 PH3 }PH1 PH2 PH3 }</pre>
ver) ver) Factor λ) rence : Φ)	<pre>{PH1 SIGMa} {PH1 SIGMa} {PH1 SIGMa} {PH1 SIGMa} {PH1 PH2 PH3 }PH1 PH2 PH3 }</pre>
ver) Factor λ) rence : Φ)	<pre>{PH1 SIGMa } {PH1 SIGMa } {PH1 SIGMa } {PH1 PH2 PH3 }PH1 PH2 PH3</pre>
rence : Φ)	<pre>{PH1 SIGMa } {PH1 SIGMa } {PH1 PH2 PH3 }PH1 PH2 PH3</pre>
rence : Φ)	{PH1 SIGMa } {PH1 PH2 PH3 {PH1 PH2 PH3 {PH1 PH2 PH3 {PH1 PH2 PH3 {PH1 PH2 PH3 {PH1 PH2 PH3
	{PH1 PH2 PH3 {PH1 PH2 PH3 {PH1 PH2 PH3 {PH1 PH2 PH3 {PH1 PH2 PH3 {PH1 PH2 PH3
	{ PH1 PH2 PH3 { PH1 PH2 PH3 { PH1 PH2 PH3 { PH1 PH2 PH3 { PH1 PH2 PH3
	{PH1 PH2 PH3 {PH1 PH2 PH3 {PH1 PH2 PH3
	{PH1 PH2 PH3
	{PH1 PH2 PH3
	{PH1 PH2 PH3
	{PH1 PH2 PH3
	{PH1 PH2 PH3
· WP)	{PH1 STGMa}
s · \W(D+)	{PH1 SIGMa}
5. WF+)	{PH1 STGMa}
5. VVF-)	(DU1 STGMa)
	{PHI SIGMa}
Juis . (+)	{PH1 SIGMa}
Juis . q-)	{PH1 SIGMa}
e nours)	{PHI SIGMa}
	{PHI SIGMa}
the load circuit)	{PHI SIGMa}
tance of the load circuit)	{PHI SIGMa}
ance of the load circuit)	{PHI SIGMa}
stance of the load circuit)	{PH1 SIGMa}
ctance of the load circuit)	{PH1 SIGMa}
it (drive efficiency))	
ase voltage unbalance	
ase current unbalance	
current)	
n time)	
	s : WP+) rs : WP-) rrs : q) purs : q+) purs : q-) e hours) the load circuit) tance of the load circuit) tance of the load circuit) stance of the load circuit) stance of the load circuit) tt (drive efficiency)) mase voltage unbalance ase current unbalance current) n time) rx1>: POWer <x2>:<</x2>

-> :ANALYSIS1:POWER1:URMS:PH1: OFFSET 1.00000E+00

Description • For the analysis items, see "Parameter list."

- This command is valid on models with the /G5 option.
 - This command is valid when DIV/Scale is set to DIV.
option.

: ANALys { PH1 PH Function	is <x1>: POWer<x2>: <parameter>: 2 PH3 SIGMa } : OPTimize Optimizes Value/Div of an analysis item in power</parameter></x2></x1>	: ANALys { PH1 PH Function	is <x1>: POWer<x2>: <parameter>: 2 PH3 SIGMa } : STATe Sets or queries the on/off status of an analysis</parameter></x2></x1>
	analysis.		item in power analysis.
Syntax	:ANALysis <x1>:POWer<x2>:<parameter></parameter></x2></x1>	Syntax	:ANALysis <x1>:POWer<x2>:<parameter></parameter></x2></x1>
	:{PH1 PH2 PH3 SIGMa}:OPTimize}		:{PH1 PH2 PH3 SIGMa}:STATe
	<x1> = 1 <x2> = 1 or 2</x2></x1>		{ <boolean>}</boolean>
Description	• For the analysis items, see "Parameter list."		:ANALysis <x1>:POWer<x2>:<parameter></parameter></x2></x1>
	This command is valid on models with the /G5		:{PH1 PH2 PH3 SIGMa}:STATe?
	option.		<x1> = 1 <x2> = 1 or 2</x2></x1>
		Example	:ANALYSIS1:POWER1:URMS:PH1:STATE 1
:ANALys	is <x1>:POWer<x2>:<parameter>:</parameter></x2></x1>		:ANALYSIS1:POWER1:URMS:PH1:STATE?
{ PH1 PH	2 PH3 SIGMa}:POSition		-> :ANALYSIS1:POWER1:URMS:PH1:
Function	Sets or queries the position of an analysis item in		STATE 1
	power analysis.	Description	For the analysis items, see "Parameter list."
Syntax	:ANALysis <x1>:POWer<x2>:<parameter></parameter></x2></x1>		This command is valid on models with the /G5
	:{PH1 PH2 PH3 SIGMa}:POSition		option.
	{ <nrf>}</nrf>		
	:ANALysis <x1>:POWer<x2>:<parameter></parameter></x2></x1>	:ANALys	<pre>is<x1>:POWer<x2>:<parameter>:</parameter></x2></x1></pre>
	:{PH1 PH2 PH3 SIGMa}:POSition?	{ PH1 PH	2 PH3 SIGMa}:VARiable
	<x1> = 1 <x2> = 1 or 2</x2></x1>	Function	Sets or queries the DIV/Scale setting of an
	<nrf> = -5.00 to 5.00 (in 0.01 steps)</nrf>		analysis item in power supply analysis.
Example	:ANALYSIS1:POWER1:URMS:PH1:	Syntax	:ANALysis <x1>:POWer<x2>:<paramet< td=""></paramet<></x2></x1>
	POSITION 0.5		er>:{PH1 PH2 PH3 SIGMa}:VARiable
	:ANALYSIS1:POWER1:URMS:PH1:POSITION?		{ <boolean>}</boolean>
	-> :ANALYSIS1:POWER1:URMS:PH1:POSITI		:ANALysis <x1>:POWer<x2>:<parameter>:</parameter></x2></x1>
	ON 0.50		{PH1 PH2 PH3 SIGMa}:VARiable?
Description	For the analysis items, see "Parameter list."		<x1> = 1 <math><x2> = 1 or 2</x2></math></x1>
	This command is valid on models with the /G5		On : SPAN Off : VDIV
	option.	Example	:ANALYSIS1:POWER1:URMS:PH1:
	This command is valid when DIV/Scale is set		VARIABLE 1
	to DIV.		:ANALYSIS1:POWER1:URMS:PH1:VARIABLE?
			-> :ANALYSISI:POWERI:URMS:PHI:VARIAB
:ANALys	<pre>is<x1>:POWer<x2>:<parameter>:</parameter></x2></x1></pre>	Decerintien	LE I
{ PHI PH	2 PH3 SIGMa } : SCALe	Description	For the analysis items, see Parameter list. This command is valid on models with the (CF)
FUNCTION	lower) of an analysis item in power analysis		• This continand is valid on models with the /GS
Syntax	· ANALysis		option.
Oyntax	:{PH1 PH2 PH3 SIGMa}:SCALe { <nrf>.</nrf>	· ANAT we	is/v1/.POWor/v2/./Paramotor/.
	<pre></pre>	JDH1 DH	2 DH3 STCM2 \ WDTV
	:ANALvsis <x1>:POWer<x2>:<parameter></parameter></x2></x1>	Function	Sets or queries the V/DIV setting of an analysis
	:{PH1 PH2 PH3 SIGMa}:SCALe?		item in power analysis
	<x1> = 1 <math><x2> = 1 or 2</x2></math></x1>	Syntax	:ANALvsis <x1>:POWer<x2>:<parameter>:</parameter></x2></x1>
	<nrf> = -9.9999E+30 to +9.9999E+30</nrf>	Cyntart	{PH1 PH2 PH3 SIGMa}:VDIV { <nrf>}</nrf>
Example	:ANALYSIS1:POWER1:URMS:PH1:		:ANALysis <x1>:POWer<x2>:<parameter>:</parameter></x2></x1>
	SCALE 4,-4		{PH1 PH2 PH3 SIGMa } : VDIV?
	:ANALYSIS1:POWER1:URMS:PH1:SCALE?		<x1> = 1 <x2> = 1 or 2</x2></x1>
	-> :ANALYSIS1:POWER1:URMS:PH1:		<nrf> = 1e-20 to 5e20</nrf>
	SCALE 4.00000E+00,-4.00000E+00	Example	:ANALYSIS1:POWER1:URMS:PH1:VDIV 2.0
Description	For the analysis items, see "Parameter list."	•	:ANALYSIS1:POWER1:URMS:PH1:VDIV?
	This command is valid on models with the /G5		-> :ANALYSIS1:POWER1:URMS:PH1:
	option.		VDIV 2.0000E+00
	This command is valid when DIV/Scale is set	Description	• For the analysis items, see "Parameter list."
	to SPAN.		This command is valid on models with the /G5 ontion

ANALysis Group

: ANALys { PH1 PH	is <x1>: POWer<x2>:<parameter>: 2 PH3 SIGMa } : ZOOM Sets or queries the vertical zoom (V Zoom) of an</parameter></x2></x1>	F
1 unodoli	analysis item in power analysis	
Syntax	:ANALysis <x1>:POWer<x2>:<parameter></parameter></x2></x1>	
e j'illan	:{PH1 PH2 PH3 SIGMa}:ZOOM { <nrf>}</nrf>	
	:ANALysis <x1>:POWer<x2>:<parameter></parameter></x2></x1>	
	:{PH1 PH2 PH3 STGMa}:ZOOM?	
	<x1> = 1 <math><x2> = 1</x2></math> or 2</x1>	E
	<pre><nrf> = 0 1 0 111 0 125 0 143 0 167 0 2 0 25</nrf></pre>	
	0.33 0.4 0.5 0.556 0.625 0.667 0.714 0.8	
	0 833 1 1 11 1 25 1 33 1 43 1 67 2 2 22 2 5	[
	3 33 4 5 6 67 8 10 12 5 16 7 20 25 40 50	
	100	
Example	:ANALYSIS1:POWER1:URMS:PH1:ZOOM 2.0	:
Example	:ANALYSIS1:POWER1:URMS:PH1:ZOOM?	F
	-> :ANALYSIS1:POWER1:URMS:PH1:	
	ZOOM 2.000	
Description	For the analysis items, see "Parameter list."	
2000.000	 This command is valid on models with the /G5 	
	option	
	This command is valid when DIV/Scale is set	E
	to DIV	
· ANAT.vs	is <x1>.POWer<x2>.PSCale</x2></x1>	[
Function	Sets or queries the φ (phase difference) scale in	
	power analysis.	
Svntax	:ANALysis <x1>:POWer<x2>:PSCale</x2></x1>	
-)	{DEGRee RADian }	
	:ANALysis <x1>:POWer<x2>:PSCale?</x2></x1>	
	<x1> = 1 <x2> = 1 or 2</x2></x1>	F
Example	:ANALYSIS1:POWER1:PSCALE RADIAN	
	:ANALYSIS1:POWER1:PSCALE?	
	-> :ANALYSIS1:POWER1:PSCALE RADIAN	
Description	This command is valid on models with the /G5	
	option.	
		E
·ANALVS	is <x1>.POWar<x2>.RTYPa</x2></x1>	
Function	Sets or queries the RMS type of an analysis item	
	in power analysis.	[
Svntax	:ANALysis <x1>:POWer<x2>:RTYPe</x2></x1>	
-,	{TRMS RMEan }	
	:ANALysis <x1>:POWer<x2>:RTYPe?</x2></x1>	
	<x1> = 1 <x2> = 1 or 2</x2></x1>	
	TRMS: True RMS (True RMS)	
	RMEan: Rectified mean value calibrated to the	
	rms value (Rect. Mean)	F
Example	:ANALYSIS1:POWER1:RTYPE RMEAN	
F	:ANALYSIS1:POWER1:RTYPE?	
	-> :ANALYSIS1:POWER1:RTYPE RMEAN	
Description	This command is valid on models with the /G5	
	option.	
	•	E

:ANALys	is <x1>:POWer<x2>:SOURce:I1</x2></x1>
Function	Sets or queries source channel I1 in power
	analysis.
Syntax	:ANALysis <x1>:POWer<x2>:SOURce:</x2></x1>
	I1 <nrf></nrf>
	:ANALysis <x1>:POWer<x2>:SOURce:I1?</x2></x1>
	<x1> = 1 <x2> = 1 or 2 <nrf> = 1 to 16</nrf></x2></x1>
Example	:ANALYSIS1:POWER1:SOURCE:I1 2
	:ANALYSIS1:POWER1:SOURCE:I1?
	-> :ANALYSIS1:POWER1:SOURCE:I1 2
Description	This command is valid on models with the /G5
	option.
:ANALys	is <x1>:POWer<x2>:SOURce:I2</x2></x1>
Function	Sets or queries source channel I2 in power
a 1	analysis.
Syntax	:ANALysis <xi>:POwer<x2>:Source:</x2></xi>
	·ANAL.vsis <v1>·POWer<v2>·SOURce·T22</v2></v1>
	<x1> = 1 <math><x2> = 1</x2></math> or 2 <math><nrf> = 1</nrf></math> to 16</x1>
Example	:ANALYSIS1: POWER1: SOURCE: 12 2
Example	:ANALYSIS1:POWER1:SOURCE:I2?
	-> :ANALYSIS1:POWER1:SOURCE:I2 2
Description	 This command is invalid when the wiring
	svstem is 1P2W.
	This command is valid on models with the /G5
	option.
:ANALys	is <x1>:POWer<x2>:SOURce:I3</x2></x1>
Function	Sets or queries source channel I3 in power
	analysis.
Syntax	:ANALysis <x1>:POWer<x2>:SOURce:</x2></x1>
	I3 <nrf></nrf>
	:ANALysis <x1>:POWer<x2>:SOURce:I3?</x2></x1>
	<x1> = 1 <x2> = 1 or 2 <nrf> = 1 to 16</nrf></x2></x1>
Example	:ANALYSIS1:POWER1:SOURCE:I3 2
	:ANALYSIS1:POWER1:SOURCE:I3?
	-> :ANALYSIS1:POWER1:SOURCE:I3 2
Description	This command is invalid when the
	wiring system is 1P2W, 1P3W, 3P3W, or
	3P3W→3V3A.
	This command is valid on models with the /G5
	option.
. 7. b7 7 T	
: ANALYS	Sets or queries source channel 11 in power
	analysis
Syntax	:ANALvsis <x1>:POWer<x2>:SOURce.</x2></x1>
Cjillan	U1 <nrf></nrf>
	:ANALysis <x1>:POWer<x2>:SOURce:U1?</x2></x1>
	<x1> = 1 <math><x2> = 1</x2></math> or 2 <math><nrf> = 1</nrf></math> to 16</x1>
Example	:ANALYSIS1:POWER1:SOURCE:U1 1
	:ANALYSIS1:POWER1:SOURCE:U1?
	-> :ANALYSIS1:POWER1:SOURCE:U1 1
Description	This command is valid on models with the /G5
	option.

: ANALys Function	is <x1>: POWer<x2>: SOURce: U2 Sets or queries source channel U2 in power</x2></x1>
Syntax	analysis. :ANALysis <x1>:POWer<x2>:SOURce:</x2></x1>
	U2 <nrf></nrf>
	:ANALysis <x1>:POWer<x2>:SOURce:U2?</x2></x1>
	<x1> = 1 <x2> = 1 or 2 <nrf> = 1 to 16</nrf></x2></x1>
Example	:ANALYSIS1:POWER1:SOURCE:U2 1
	:ANALYSIS1:POWER1:SOURCE:U2?
Deceriation	-> :ANALYSISI:POWERI:SOURCE:U2 I
Description	This command is invalid when the winning system is 1P2W/
	 This command is valid on models with the /G5
	option.
• ANAT we	i
Function	Sets or queries source channel U3 in power
1 dilotion	analysis.
Syntax	:ANALysis <x1>:POWer<x2>:SOURce:</x2></x1>
	U3 <nrf></nrf>
	:ANALysis <x1>:POWer<x2>:SOURce:U3?</x2></x1>
	<x1> = 1 <x2> = 1 or 2 <nrf> = 1 to 16</nrf></x2></x1>
Example	:ANALYSIS1:POWER1:SOURCE:U3 1
	:ANALYSIS1: POWER1: SOURCE: U3?
Description	ANALYSISI: POWERT: SOURCE: 03 1 This command is invalid when the
Description	wiring system is 1P2W 1P3W 3P3W or
	3P3W→3V3A.
	This command is valid on models with the /G5
	option.
· ANALue	i << v1 > · DOWord v2 > · TEDM2
Function	Queries all calculation period settings of power
	analysis (Wiring System1 or Wiring System2).
Svntax	:ANALysis <x1>:POWer<x2>:TERM?</x2></x1>
-)	<x1> = 1</x1>
	<x2> = 1 or 2</x2>
	When $\langle x2 \rangle = 1$: Calculation period setting of
	Wiring System1
	When $\langle x^2 \rangle = 2$: Calculation period setting of
	Wiring System2
Description	This command is valid on models with the /G5
	option.
:ANALvs	is <x1>:POWer<x2>:TERM:ATIMer</x2></x1>
Function	Sets or queries the update time of the calculation
	period in power analysis.
Syntax	:ANALysis <x1>:POWer<x2>:ATIMer</x2></x1>
	{ <time>}</time>
	:ANALysis <x1>:POWer<x2>:ATIMer?</x2></x1>
	<x1> = 1 <x2> = 1 or 2</x2></x1>
	<nrf> = 100ns to 500ms</nrf>
Example	:ANALYSIS1:POWER1:TERM:ATIMER 50e-3
	:ANALYSIS1:POWER1:TERM:ATIMER?
	-> :ANALYSIS1:POWER1:TERM:
	ATIMER 50e-3
Description	This command is valid when the calculation
	period type is set to Auto Timer or AC+DC.
	This command is valid on models with the /G5
	option.

Function	Sets or queries the edge source filter for the
	calculation period in power analysis.
Syntax	:ANALysis <x1>:POWer<x2>:TERM:</x2></x1>
	FILTer {OFF <frequency>}</frequency>
	:ANALysis <x1>:POWer<x2>:</x2></x1>
	TERM:ESFilter?
	<x1> = 1 <x2> = 1 or 2</x2></x1>
	<pre><frequency> = 62.5Hz, 125Hz, 250Hz, 500Hz,</frequency></pre>
	1kkHz, 2kHz,4kHz, 8kHz, 16kHz, 32kHz, 64kHz,
Tyomple	128KHZ
Example	REALISISI. FOWERI: IERM:
	:ANALYSIS1: POWER1: TERM: ESFILTER?
	-> :ANALYSIS1:POWER1:TERM:
	ESFILTER 128E+03
Description	• This command is invalid when the calculation
	period type is set to Auto Timer.
	This command is valid on models with the /G5
	option.
:ANALys	is <x1>:POWer<x2>:TERM:HYSTere</x2></x1>
Function	Sets or gueries the hysteresis for the calculation
	period in power analysis.
Syntax	:ANALysis <x1>:POWer<x2>:TERM:HYSTere</x2></x1>
-)	sis {HIGH LOW MIDDle}
	:ANALysis <x1>:POWer<x2>:TERM:HYSTere</x2></x1>
	sis?
	<x1> = 1 <x2> = 1 or 2</x2></x1>
Example	:ANALYSIS1:POWER1:TERM:
	HYSTERESIS MIDDLE
	:ANALYSIS1:POWER1:TERM:HYSTERESIS?
	-> :ANALYSIS1:POWER1:TERM:
	HYSTERESIS MIDDLE
Description	This command is invalid when the calculation
20000.000	period type is set to Auto Timer
	 This command is valid on models with the /G5
	option.
:ANALys	is <x1>:POWer<x2>:TERM:ESOurce</x2></x1>
: ANALys Function	is <x1>: POWer<x2>: TERM: ESOurce Sets or queries the edge detection source</x2></x1>
: ANALys Function	is <x1>: POWer<x2>: TERM: ESOurce Sets or queries the edge detection source channel for the calculation period in power</x2></x1>
: ANALys Function	is < x1 >: POWer < x2 >: TERM : ESOurce Sets or queries the edge detection source channel for the calculation period in power analysis.
: ANALys Function Syntax	Sets or queries the edge detection source channel for the calculation period in power analysis. : ANALysis <x1>: POWer<x2>: TERM:</x2></x1>
: ANALys Function Syntax	Sets or queries the edge detection source channel for the calculation period in power analysis. :ANALysis <x1>:POWer<x2>:TERM: ESOurce {OWNU OWNI U1 U2 U3 I1 I2 I3</x2></x1>
: ANALys Function Syntax	<pre>sis<x1>: POWer<x2>: TERM: ESOurce Sets or queries the edge detection source channel for the calculation period in power analysis. :ANALysis<x1>: POWer<x2>: TERM: ESOurce {OWNU OWNI U1 U2 U3 I1 I2 I3 OTHer}</x2></x1></x2></x1></pre>
: ANALys Function Syntax	Sets or queries the edge detection source channel for the calculation period in power analysis. :ANALysis <x1>:POWer<x2>:TERM: ESOurce {OWNU OWNI U1 U2 U3 I1 I2 I3 OTHer} :ANALysis<x1>:POWer<x2>:TERM:ESOur</x2></x1></x2></x1>
: ANALys Function Syntax	<pre>sis<x1>: POWer<x2>: TERM: ESOurce Sets or queries the edge detection source channel for the calculation period in power analysis. :ANALysis<x1>: POWer<x2>: TERM: ESOurce {OWNU OWNI U1 U2 U3 I1 I2 I3 OTHer} :ANALysis<x1>: POWer<x2>: TERM: ESOur ce?</x2></x1></x2></x1></x2></x1></pre>
: ANALys Function Syntax	<pre>sis<x1>: POWer<x2>: TERM: ESOurce Sets or queries the edge detection source channel for the calculation period in power analysis. :ANALysis<x1>: POWer<x2>: TERM: ESOurce {OWNU OWNI U1 U2 U3 I1 I2 I3 OTHer} :ANALysis<x1>: POWer<x2>: TERM: ESOur ce? <x1> = 1 <x2> = 1 or 2</x2></x1></x2></x1></x2></x1></x2></x1></pre>
: ANALys Function Syntax Example	<pre>sis<x1>: POWer<x2>: TERM: ESOurce Sets or queries the edge detection source channel for the calculation period in power analysis. :ANALysis<x1>: POWer<x2>: TERM: ESOurce {OWNU OWNI U1 U2 U3 I1 I2 I3 OTHer} :ANALysis<x1>: POWer<x2>: TERM: ESOur ce? <x1> = 1</x1></x2></x1></x2></x1></x2></x1></pre>
: ANALys Function Syntax Example	<pre>sis<x1>: POWer<x2>: TERM: ESOurce Sets or queries the edge detection source channel for the calculation period in power analysis. :ANALysis<x1>: POWer<x2>: TERM: ESOurce {OWNU OWNI U1 U2 U3 I1 I2 I3 OTHer} :ANALysis<x1>: POWer<x2>: TERM: ESOurce ce? <x1> = 1</x1></x2></x1></x2></x1></x2></x1></pre>
: ANALys Function Syntax Example	<pre>sis<x1>: POWer<x2>: TERM: ESOurce Sets or queries the edge detection source channel for the calculation period in power analysis. :ANALysis<x1>: POWer<x2>: TERM: ESOurce {OWNU OWNI U1 U2 U3 I1 I2 I3 OTHer} :ANALysis<x1>: POWer<x2>: TERM: ESOurc ce? <x1> = 1</x1></x2></x1></x2></x1></x2></x1></pre>
: ANALys Function Syntax Example	<pre>sis<x1>: POWer<x2>: TERM: ESOurce Sets or queries the edge detection source channel for the calculation period in power analysis. :ANALysis<x1>: POWer<x2>: TERM: ESOurce {OWNU OWNI U1 U2 U3 I1 I2 I3 OTHer} :ANALysis<x1>: POWer<x2>: TERM: ESOurc ce? <x1> = 1</x1></x2></x1></x2></x1></x2></x1></pre>
: ANALys Function Syntax Example Description	<pre>sis<x1>: POWer<x2>: TERM: ESOurce Sets or queries the edge detection source channel for the calculation period in power analysis. :ANALysis<x1>: POWer<x2>: TERM: ESOurce {OWNU OWNI U1 U2 U3 I1 I2 I3 OTHer} :ANALysis<x1>: POWer<x2>: TERM: ESOUrc ce? <x1> = 1</x1></x2></x1></x2></x1></x2></x1></pre>
: ANALys Function Syntax Example Description	<pre>sis<x1>: POWer<x2>: TERM: ESOurce Sets or queries the edge detection source channel for the calculation period in power analysis. :ANALysis<x1>: POWer<x2>: TERM: ESOurce {OWNU OWNI U1 U2 U3 I1 I2 I3 OTHer} :ANALysis<x1>: POWer<x2>: TERM: ESOUrce ce? <x1> = 1</x1></x2></x1></x2></x1></x2></x1></pre>
: ANALys Function Syntax Example Description	<pre>Sis<x1>: POWer<x2>: TERM: ESOurce Sets or queries the edge detection source channel for the calculation period in power analysis. :ANALysis<x1>: POWer<x2>: TERM: ESOurce {OWNU OWNI U1 U2 U3 I1 I2 I3 OTHer} :ANALysis<x1>: POWer<x2>: TERM: ESOur ce? <x1> = 1</x1></x2></x1></x2></x1></x2></x1></pre>

ANALysis Group

: ANALys TERM: ST	is <x1>: POWer<x2>: OPpredict Sets or queries the stop prediction of the</x2></x1>
	calculation period in power analysis
Syntax	·ANALysis <x1>·POWer<x2>·TERM·STOPpre</x2></x1>
Oymax	dict <nrf></nrf>
	·ANALysis(v1)·POWer(v2)·TERM·STOPpre
	dict2
	$x_{1} = 1$ $x_{2} = 1 \text{ or } 2$
	-1012
Evampla	-NRI 2, 4, 0, 10
Litample	·ANALYSTS1. DOWER1. TERM. STOTTREDICT 0
	-> ·ANALVSIS1.DOWER1.TERM.STOTTABDICT.
	STOPPREDICT 8
Description	This command is valid when the calculation
Description	poriod type is set to AC or AC+DC
	 This command is valid on models with the /G5
	option.
: ANALys	is <x1>: POWer<x2>: TERM: TYPE</x2></x1>
1 unction	nower analysis
Syntax	·ANALysis <v1>·POWer<v2>·TERM·TYPE</v2></v1>
Oymax	{EDGELATIMerlaClaC DC}
	:ANALysis <x1>: POWer<x2>: TERM: TYPE?</x2></x1>
	$< x_1 > = 1$ $< x_2 > = 1 \text{ or } 2$
Evample	·ANALYSTS1·POWER1·TERM·TYPE AC DC
Livampie	·ANALYSISI · DOWERI · TERM · TYPE?
	-> ·ANALYSIS1·POWER1·TERM·TYPE AC DC
Description	This command is valid on models with the /G5
Decomption	option.
:ANALys	is <x1>:POWer<x2>:TERM:OCHann</x2></x1>
el	Cate on supprise the share all supplies when the
Function	Sets or queries the channel number when the
	edge detection source for the calculation period is
0	set to Other Channel In power analysis.
Syntax	:ANALysis <xi>:POwer<x2>:TERM:OCHann</x2></xi>
	el { <nri>}</nri>
	:ANALysis <x1>:POwer<x2>:TERM:OCHann</x2></x1>
	el?
	<x1> = 1 <x2> = 1 or 2</x2></x1>
	<nrt> = 1 to 16</nrt>
Example	:ANALYSIS1:POWER1:TERM:OCHANNEL 1
	:ANALYSIS1:POWER1:TERM:OCHANNEL?
	-> :ANALYSIS1:POWER1:TERM:
_	OCHANNEL 1
Description	This command is invalid when the calculation
	period type is set to Auto Timer.
	This command is valid on models with the /G5 option.

:ANALys	is <x1>:POWer<x2>:WIRing</x2></x1>
Function	Sets or queries the wiring system in power
	analysis.
Syntax	:ANALysis <x1>:POWer<x2>:WIRing {P1W</x2></x1>
	2 P1W3 P3W3 V3A3 P3W4},{OFF P3W3_
	V3A3 DT_ST ST_DT}
	:ANALysis <x1>:POWer<x2>:WIRing?</x2></x1>
	<x1> = 1 <x2> = 1 or 2</x2></x1>
	P1W2 P1W3 P3W3 V3A3 P3W4: wiring system
	selection
	OFF P3W3_V3A3 DT_ST ST_DT: delta math
	selection
Example	:ANALysis1:POWer1:WIRing P3W3,OFF
	:ANALysis1:POWer1:WIRing? ->
	:ANALYSIS1:POWER1:WIRING P34W,ST_DT
Description	Match the wiring system to the conversion
	source system of delta math.
	• This command is valid on models with the /G5
	option.

The commands in this group deal with real time math. You can perform the same operations and make the same settings and queries that you can make from the Filter/Delay Setup menu that you access by pressing a key from CH1 to CH16 on the front panel or by accessing the menus for channels RMATh1 to RMATh16.

anotion	Sets or queries the scale of the specified
	channel's angle difference operation.
Syntax	:CHANnel <x>:RMATh:AMINus:</x>
,	SCALe {DEGRee RADian}
	:CHANnel <x>:RMATh:AMTNus:SCALe?</x>
	<x> = 1 to 16</x>
Example	CHANNELL:RMATH:AMINUS:SCALE DEGREE
Example	·CHANNEL1 · RMATH · AMINUS · SCALE?
	-> ·CHANNEL1·RMATH·AMINUS·
	SCALE DEGREE
Description	This command is valid on models with the /G3 or
Description	/G5 option
·CHANDO	
Function	Sets or queries the scale of the specified
	channel's arc tangent operation
Svntax	:CHANnel <x>:RMATh:ATANgent:</x>
-)	SCALe {DEGRee RADian }
	:CHANnel <x>:RMATh:ATANgent:SCALe?</x>
	<x1> = 1 to 16</x1>
Example	:CHANNEL1:RMATH:ATANGENT:
	SCALE DEGREE
	:CHANNEL1:RMATH:ATANGENT:SCALE?
	-> :CHANNEL1:RMATH:ATANGENT:
	SCALE DEGREE
Description	This command is valid on models with the /G3 or
	/G5 option.
	• • • • • • • • • • • • • • • • • • • •
: CHANne	L(x>: RMATh: ATANgent: QUADrant
Function	Sets or queries the quadrant range for the
	arctangent calculation of the specified channel.
Example	:CHANnel <x>:RMATh:ATANgent:</x>
	QUADrant {2 4}
	:CHANnel <x>:RMATh:ATANgent:QUADrant?</x>
	<x> = 1 to 16</x>
Example	:CHANNEL:RMATH:ATANGENT:QUADRANT 2
	:CHANNEL:RMATH:ATANGENT:QUADRANT?
	-> :CHANNEL:RMATH:ATANGENT:
	QUADRANT 2
Description	This command is valid on models with the /G3 or
Description	

CHANnel<x>:RMATh:AVALue

:CHANNE	1 <x>:RMATh:AVALue</x>
Function	Sets or queries coefficient A of the currently
	specified real time math operation.
Syntax	:CHANnel <x>:RMATh:AVALue {<nrf>}</nrf></x>
	:CHANnel <x>:RMATh:AVALue?</x>
	<x> = 1 to 16</x>
	<nrf> = -9.9999E+30 to +9.9999E+30</nrf>
Example	:CHANNEL1:RMATH:AVALUE +1.0000E+30
	:CHANNEL1:RMATH:AVALUE?
	-> :CHANNEL1:RMATH:AVALUE+ 1.0000E+30
Description	This command is valid on models with the /G3 or /G5 option.
·CHANne	l <x>·RMATh·RVALue</x>
Function	Sets or queries coefficient B of the currently
	specified real time math operation
Syntax	·CHANnel <x>·RMATh·BVALue {<nrf>}</nrf></x>
Oyntax	·CHANnel <v>·RMATh·BVALue?</v>
	< x > = 1 to 16
	\sim = 1 to 10
Evampla	CUNNET 1. DMATH. DVALUE 11 0000E130
схаттріє	CHANNELI, MAIN, BVALUE TI, 0000ET30
	CHANNELL. MAIN. BVALUE 11 0000E120
Description	This command is valid on models with the (C2 or
Description	This command is valid on models with the /G3 of
	/G5 option.
: CHANne	I <x>: RMATh: BWIDth: BAND</x>
Function	Sets of queries the band of the specified
a <i>i</i>	channel's digital filter.
Syntax	:CHANnel <x>:RMATh:BWIDth:</x>
	BAND {BPASs HPASs LPASs}
	:CHANnel <x>:RMATh:BWIDth:BAND?</x>
	<x> = 1 to 16</x>
Example	:CHANNEL1:RMATH:BWIDTH:BAND BPASS
	:CHANNEL1:RMATH:BWIDTH:BAND?
	-> :CHANNEL1:RMATH:BWIDTH:BAND BPASS
Description	 This command is valid on models with the /G3 or /G5 option.
	You cannot set this setting for the channels of
	an installed 16-CH voltage input module 16-
	CH temperature/voltage input module logic
	input module CAN bus monitor module CAN
	& LIN bus monitor module or CAN/CAN FD
	monitor module
	When the digital filter type is "GALISs." you can
	only select LPASs
	5, 5000(L) / (60.

		- DHIDAL CED			- DUIDEL OUT - SS
Eunction	Sets or queries	the center frequency of the	Eunction	Sets or queries	the cutoff frequency of the
T UTICUOT	bandnass filter	of the specified channel's digital	1 unction	specified chann	alle cuton nequency of the
	filter	of the specified channel's digital	Syntax	·CHANnel <v></v>	• RMATH • RWIDth •
Syntax	·CHANnel <v></v>	• RMATH• RWID+h•	Gyntax	{CUTOffl <fr< td=""><td></td></fr<>	
Oymax	CFRequency	{ <frequency>}</frequency>		·CHANnel <x></x>	•RMATh•RWIDth•CUToff?
	:CHANnel <x></x>	:RMATh:BWIDth:CFRequency?		<x> = 1 to 16</x>	
	<x> = 1 to 16</x>			<frequency>:</frequency>	
	<frequency>:</frequency>			When TYPE	is set to GAUSs or when TYPE is
	When TYPF	is set to IIR		set to SHAR	and BAND is set to LPASs
		60Hz to 300kHz			2Hz to 300kHz
	Resolution	20Hz (60Hz to 1.18kHz)		Resolution	0.2Hz (2Hz to 29.8Hz)
		200Hz (1.2kHz to 11.8kHz)			2Hz (30Hz to 298Hz)
		2kHz (12kHz to 294kHz)			20Hz (300Hz to 2.98kHz)
	When TYPE	is set to SHARp			200Hz (3kHz to 29.8kHz)
		300Hz to 300kHz			2kHz (30kHz to 300kHz)
	Resolution	20Hz (300Hz to 2.98kHz)		When TYPE	is set to SHARp and BAND is set
		200Hz (3kHz to 29.8kHz)		to HPASs	
		2kHz (30kHz to 290kHz)			200Hz to 300kHz
Example	:CHANNEL1:RM	MATH:BWIDTH:		Resolution	20Hz (200Hz to 2.98kHz)
	CFREQUENCY 3	300Hz			200Hz (3kHz to 29.8kHz)
	:CHANNEL1:RM	MATH:BWIDTH:			2kHz (30kHz to 300kHz)
	CFREQUENCY?			When TYPE	is set to IIR and BAND is set to
	-> :CHANNEL1	:RMATH:BWIDTH:		LPASs	
	CFREQUENC	Y 300Hz			2Hz to 300kHz
Description	• This comman	nd is valid on models with the /G3		Resolution	2Hz (2Hz to 298Hz)
	or /G5 option				20Hz (300Hz to 2.98kHz)
	You cannot s	let this setting for the channels of			200HZ (3KHZ to 29.8KHZ)
				When TVDE	is set to UP and RAND is set to
	input module	CAN bus monitor module. CAN			is set to fire and band is set to
	& LIN bus m	philor module, or CAN/CAN FD		111 703	20Hz to 300kHz
	monitor modu			Resolution	20Hz (20Hz to 2.98kHz)
					200Hz (3kHz to 29.8kHz)
					2kHz (30kHz to 300kHz)
			Example	:CHANNEL1:R	MATH:BWIDTH:CUTOFF 300kHz
				:CHANNEL1:RM	MATH:BWIDTH:CUTOFF?
				-> :CHANNEL	1:RMATH:BWIDTH:
				CUTOFF 30	OOkHz
			Description	• This commar	nd is valid on models with the /G3
				or /G5 option	l.
				 You cannot s 	et this setting for the channels of
				an installed 1	6-CH voltage input module, 16-
				CH temperat	ure/voltage input module, logic
				input module	, CAN bus monitor module, CAN
				& LIN DUS MO	DNITOR MODULE, OF CAN/CAN FD
				• When the die	ule.
				only select L	
				only select LI	
			1		

:CHANnel<x>:RMATh:BWIDth:INTerpo

Function	Sets or queries the interpolation function of the
1 unction	specified channel's digital filter
Suntay	·CHANDOL / V. V. PMATTH · PWIDth ·
Syntax	INTerne (Cheeleen)
	INTELPO {\DOOLEAN>}
	:CHANNEL <x>:RMAIN:BWIDCN:INTerpo?</x>
E	
Example	:CHANNELI:RMATH:BWIDTH:INTERPO I
	:CHANNELI:RMATH:BWIDTH:INTERPO?
	-> :CHANNEL1:RMATH:BWIDTH:INTERPO 1
Description	 This command is valid on models with the /G3
	or /G5 option.
	 You cannot set this setting for the channels of
	an installed 16-CH voltage input module, 16-
	CH temperature/voltage input module, logic
	input module, CAN bus monitor module, CAN
	& LIN bus monitor module, or CAN/CAN FD
	monitor module.
: CHANNE	Queries all mean acttings of the encoified
FUNCTION	quenes all mean settings of the specified
Curatavi	
Syntax	This segment is welled as used all with the (00 as
Description	I his command is valid on models with the /G3 or
	/G5 option.
: CHANne	l <x>:RMATh:BWIDth:MEAN:SAMPle</x>
(Base S	ample)
Function	Sets or gueries the sample of the mean of the
	specified channel's digital filter.
Svntax	:CHANnel <x>:RMATh:BWIDth:MEAN:SAMPle</x>
- ,	<frequency></frequency>
	:CHANnel <x>:RMATh:BWIDth:MEAN:SAMP</x>
	le?
	<x> = 1 to 16</x>
	<frequency>: 1MHz, 100kHz, 10kHz, 1kHz</frequency>
Example	:CHANNEL1:RMATH:BWIDTH:MEAN:
	SAMPLE 1MHz
	:CHANNEL1:RMATH:BWIDTH:MEAN:SAMPLE?
	-> :CHANNEL1:RMATH:BWIDTH:MEAN:SAMP
	LE 1MHz
Description	This command is valid on models with the /G3
	or /G5 option.
	You cannot set this setting for the channels of
	-
	an installed 16-CH Voltage input module, 16-
	an installed 16-CH Voltage input module, 16- CH temperature/voltage input module, logic
	an installed 16-CH Voltage input module, 16- CH temperature/voltage input module, logic input module, CAN bus monitor module. CAN
	an installed 16-CH Voltage input module, 16- CH temperature/voltage input module, logic input module, CAN bus monitor module, CAN & LIN bus monitor module, or CAN/CAN FD

Function	Sets or queries the taps of the mean of the
	specified channel's digital filter.
Svntax	:CHANnel <x>:RMATh:BWIDth:MEAN:</x>
-)	TAP { <nrf>}</nrf>
	:CHANnel <x>:RMATh:BWIDth:MEAN:TAP?</x>
	<x> = 1 to 16</x>
	<nrf> = 2, 4, 8, 16, 32, 64, 128</nrf>
Example	:CHANNEL1:RMATH:BWIDTH:MEAN:TAP 4
	:CHANNEL1:RMATH:BWIDTH:MEAN:TAP?
	-> :CHANNEL1:RMATH:BWIDTH:MEAN:TAP
Description	• This command is valid on models with the /G
2000.101.011	or /G5 option
	 You cannot set this setting for the channels of
	an installed 16-CH voltage input module 16-
	CH temperature/voltage input module logic
	input module CAN bus monitor module CAN
	& LIN bus monitor module, or CAN/CAN ED
	& LIN bus monitor module, or CAN/CAN FD monitor module
	& LIN bus monitor module, or CAN/CAN FD monitor module.
: CHANne	<pre>& LIN bus monitor module, or CAN/CAN FD monitor module. l<x>:RMATh:BWIDth:MODE</x></pre>
: CHANne Function	 & LIN bus monitor module, or CAN/CAN FD monitor module. 1<x>: RMATh : BWIDth : MODE</x> Sets or queries the filter mode of the specified
: CHANne Function	 & LIN bus monitor module, or CAN/CAN FD monitor module. 1<x>: RMATh: BWIDth: MODE</x> Sets or queries the filter mode of the specified channel.
: CHANne Function Syntax	<pre>& LIN bus monitor module, or CAN/CAN FD monitor module. !<x>: RMATh : BWIDth : MODE Sets or queries the filter mode of the specified channel. :CHANnel<x>: RMATh : BWIDth :</x></x></pre>
: CHANne Function Syntax	<pre>& LIN bus monitor module, or CAN/CAN FD monitor module. l<x>:RMATh:BWIDth:MODE Sets or queries the filter mode of the specified channel. :CHANnel<x>:RMATh:BWIDth: MODE {LPF DIGital}</x></x></pre>
: CHANne Function Syntax	<pre>& LIN bus monitor module, or CAN/CAN FD monitor module. l<x>: RMATh : BWIDth : MODE Sets or queries the filter mode of the specified channel. :CHANnel<x>: RMATh : BWIDth : MODE {LPF DIGital} :CHANnel<x>: RMATh : BWIDth : MODE?</x></x></x></pre>
: CHANne Function Syntax	<pre>& LIN bus monitor module, or CAN/CAN FD monitor module. l<x>: RMATh : BWIDth : MODE Sets or queries the filter mode of the specified channel. :CHANnel<x>: RMATh : BWIDth : MODE {LPF DIGital} :CHANnel<x>: RMATh : BWIDth : MODE? <x> = 1 to 16</x></x></x></x></pre>
: CHANne Function Syntax Example	<pre>& LIN bus monitor module, or CAN/CAN FD monitor module. l<x>: RMATh: BWIDth: MODE Sets or queries the filter mode of the specified channel. :CHANnel<x>:RMATh:BWIDth: MODE {LPF DIGital} :CHANnel<x>:RMATh:BWIDth:MODE? <x> = 1 to 16 :CHANNEL1:RMATH:BWIDTH:MODE LPF</x></x></x></x></pre>
: CHANne Function Syntax Example	<pre>& LIN bus monitor module, or CAN/CAN FD monitor module. l<x>: RMATh : BWIDth : MODE Sets or queries the filter mode of the specified channel. :CHANnel<x>:RMATh:BWIDth: MODE {LPF DIGital} :CHANnel<x>:RMATh:BWIDth:MODE? <x> = 1 to 16 :CHANNEL1:RMATH:BWIDTH:MODE LPF :CHANNEL1:RMATH:BWIDTH:MODE</x></x></x></x></pre>
: CHANne Function Syntax Example	<pre>& LIN bus monitor module, or CAN/CAN FD monitor module. L<x>: RMATh : BWIDth : MODE Sets or queries the filter mode of the specified channel. :CHANnel<x>:RMATh:BWIDth: MODE {LPF DIGital} :CHANnel<x>:RMATh:BWIDth:MODE? <xx> = 1 to 16 :CHANNEL1:RMATH:BWIDTH:MODE LPF :CHANNEL1:RMATH:BWIDTH:MODE LPF -> :CHANNEL1:RMATH:BWIDTH:MODE LPF</xx></x></x></x></pre>
: CHANNE Function Syntax Example Description	<pre>& LIN bus monitor module, or CAN/CAN FD monitor module. l<x>: RMATh : BWIDth : MODE Sets or queries the filter mode of the specified channel. :CHANnel<x>: RMATh : BWIDth : MODE {LPF DIGital} :CHANnel<x>: RMATh : BWIDth : MODE? <xx> = 1 to 16 :CHANNEL1: RMATH : BWIDTH : MODE LPF :CHANNEL1: RMATH : BWIDTH : MODE LPF . CHANNEL1: RMATH : BWIDTH : MODE LPF . This command is valid on models with the /G</xx></x></x></x></pre>
: CHANNE Function Syntax Example Description	<pre>& LIN bus monitor module, or CAN/CAN FD monitor module. !<a>(x>: RMATh: BWIDth: MODE Sets or queries the filter mode of the specified channel. :CHANnel<x>: RMATh: BWIDth: MODE {LPF DIGital} :CHANnel<x>: RMATh: BWIDth: MODE? <a>(x> = 1 to 16 :CHANNEL1: RMATH: BWIDTH: MODE LPF :CHANNEL1: RMATH: BWIDTH: MODE LPF . This command is valid on models with the /G or /G5 option.</x></x></pre>
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: CHANne Function Syntax Example Description	<pre>& LIN bus monitor module, or CAN/CAN FD monitor module. l<x>: RMATh : BWIDth : MODE Sets or queries the filter mode of the specified channel. :CHANnel<x>:RMATh : BWIDth : MODE {LPF DIGital} :CHANnel<x>:RMATh : BWIDth : MODE? <x> = 1 to 16 :CHANNEL1 : RMATH : BWIDTH : MODE LPF :CHANNEL1 : RMATH : BWIDTH : MODE LPF :CHANNEL1 : RMATH : BWIDTH : MODE LPF • This command is valid on models with the /G or /G5 option. • You cannot set this setting for the channels c an installed 16-CH voltage input module, logic</x></x></x></x></pre>
: CHANNE Function Syntax Example Description	<pre>& LIN bus monitor module, or CAN/CAN FD monitor module. l<x>: RMATh : BWIDth : MODE Sets or queries the filter mode of the specified channel. :CHANnel<x>:RMATh : BWIDth : MODE {LPF DIGital} :CHANnel<x>:RMATh : BWIDth :MODE? <x> = 1 to 16 :CHANNEL1 :RMATH : BWIDTH : MODE LPF :CHANNEL1 :RMATH : BWIDTH :MODE LPF :CHANNEL1 :RMATH : BWIDTH :MODE LPF • This command is valid on models with the /G or /G5 option. • You cannot set this setting for the channels c an installed 16-CH voltage input module, logic insut module. CAN here modifies and the context.</x></x></x></x></pre>
: CHANne Function Syntax Example Description	 & LIN bus monitor module, or CAN/CAN FD monitor module. 1<x>: RMATh: BWIDth: MODE</x> Sets or queries the filter mode of the specified channel. : CHANnel<x>: RMATh: BWIDth:</x> MODE {LPF DIGital} : CHANnel<x>: RMATh: BWIDth: MODE?</x> <x> = 1 to 16</x> : CHANNEL1: RMATH: BWIDTH: MODE LPF : CHANNEL1: RMATH: BWIDTH: MODE LPF : CHANNEL1: RMATH: BWIDTH: MODE LPF Or /G5 option. You cannot set this setting for the channels of an installed 16-CH voltage input module, logic input module, CAN bus monitor module, CAN
: CHANNE Function Syntax Example Description	 & LIN bus monitor module, or CAN/CAN FD monitor module. 1<x>: RMATh: BWIDth: MODE</x> Sets or queries the filter mode of the specified channel. : CHANnel<x>: RMATh: BWIDth:</x> MODE {LPF DIGital} : CHANnel<x>: RMATh: BWIDth: MODE?</x> <x> = 1 to 16</x> : CHANNEL1: RMATH: BWIDTH: MODE LPF : CHANNEL1: RMATH: BWIDTH: MODE LPF : CHANNEL1: RMATH: BWIDTH: MODE LPF • This command is valid on models with the /G or /G5 option. You cannot set this setting for the channels of an installed 16-CH voltage input module, 16-CH temperature/voltage input module, logic input module, CAN bus monitor module, CAN & LIN bus monitor module, or CAN/CAN FD

:CHANne Band)	l <x>:RMATh:BWIDth:PBANd (Pass</x>	:CH
Function	Sets or queries the bandwidth of the bandpass	Funct
	filter of the specified channel's digital filter.	
Syntax	:CHANnel <x>:RMATh:BWIDth:</x>	Synta
	PBANd { <frequency>}</frequency>	
	:CHANnel <x>:RMATh:BWIDth:PBANd?</x>	
	<x> = 1 to 16</x>	
	<frequency>:</frequency>	
	When TYPE is set to IIR	
	200kHz, 150kHz, 100kHz, 50kHz,	Exam
	20kHz, 15kHz, 10kHz, 5kHz, 2kHz,	
	1.5kHz, 1kHz, 500Hz, 200Hz, 100Hz	
	When TYPE is set to SHARp	Desc
	200kHz, 150kHz, 100kHz, 50kHz,	
	20kHz, 15kHz, 10kHz, 5kHz, 2kHz,	
	1.5kHz, 1kHz, 500Hz, 200Hz	(Me
Example	:CHANNEL1:RMATH:BWIDTH:PBAND 200Hz	Funct
	:CHANNEL1:RMATH:BWIDTH:PBAND?	
	-> :CHANNEL1:RMATH:BWIDTH:	Synta
	PBAND 200Hz	
Description	I his command is valid on models with the /G3	
	or /G5 option.	
	You cannot set this setting for the channels of	Exam
	an installed 16-CH voltage input module, 16-	
	CH temperature/voltage input module, logic	
	Input module, CAN bus monitor module, CAN	Desc
	& LIN bus monitor module, or CAN/CAN FD	
	Monitor module.	
	When the center frequency is changed, if the frequency approaches the bandwidth limit, the	:CH
	handwidth is changed	ID)
	bandwidth is changed.	i unci
: CHANne	l <x>:RMATh:BWIDth:TYPE</x>	Synta
Function	Sets or queries the digital filter type of the	
	specified channel.	
Syntax	:CHANnel <x>:RMATh:BWIDth:</x>	
	TYPE {GAUSs IIR SHARp MEAN}	
	:CHANnel <x>:RMATh:BWIDth:TYPE?</x>	
	<x> = 1 to 16</x>	
Example	:CHANNEL1:RMATH:BWIDTH:TYPE IIR	Evon
	:CHANNEL1:RMATH:BWIDTH:TYPE?	Exam
	-> :CHANNEL1:RMATH:BWIDTH:TYPE IIR	
Description	 This command is valid on models with the /G3 	Desci
	or /G5 option.	
	 You cannot set this setting for the channels of 	
	an installed 16-CH voltage input module, 16-	Eunct
	CH temperature/voltage input module, logic	
	input module, CAN bus monitor module, CAN	Synta
	& LIN bus monitor module, or CAN/CAN FD	
	monitor module.	
		Fxam
		Doco
		1 DESC

ANnel<x>:RMATh:CANId:BRATe (Bit e) tion Sets or queries the CAN ID bit rate of the specified channel. :CHANnel<x>:RMATh:CANId: IX BRATe {<NRf>} :CHANnel<x>:RMATh:CANId:BRATe? <x> = 1 to 16 <NRf> = 10000, 20000, 33300, 50000, 62500, 66700, 83300, 100000, 125000, 200000, 250000, 400000, 500000, 800000, 1000000 :CHANNEL:RMATH:CANID:BRATE 500000 ple :CHANNEL:RMATH:CANID:BRATE? -> :CHANNEL:RMATH:CANID:BRATE 500000 ription This command is valid on models with the /G3 or /G5 option. ANnel<x>:RMATh:CANId:MFORmat ssage Format) tion Sets or queries the CAN ID message format of the specified channel. IX :CHANnel<x>:RMATh:CANId: MFORmat {STANDard|EXTended} :CHANnel<x>:RMATh: CANId:MFORmat? <x> = 1 to 16 ple :CHANNEL:RMATH:CANID:MFORMAT STANDARD :CHANNEL:RMATH:CANID:MFORMAT? -> :CHANNEL:RMATH:CANID: MFORMAT STANDARD ription This command is valid on models with the /G3 or /G5 option. ANnel<x>:RMATh:CANId:MID (Message tion Sets or queries the CAN ID message ID of the specified channel. :CHANnel<x>:RMATh:CANId: IX MID {<String>} :CHANnel<x>:RMATh:CANId:MID? <x> = 1 to 16 · When MFormat is set to Standard <String> = "0" to "7FF" · When MFormat is set to Extended <String> = "0" to "1FFFFFFF" :CHANNEL:RMATH:CANID:MID "7FF" ple :CHANNEL:RMATH:CANID:MID? -> :CHANNEL:RMATH:CANID:MID "7FF" ription This command is valid on models with the /G3 or /G5 option. ANnel<x>:RMATh:CANId:SOURce Sets or queries the CAN ID detection source tion waveform of the specified channel. :CHANnel<x>:RMATh:CANId: IX SOURce {<NRf>} :CHANnel<x>:RMATh:CANId:SOURce? <x> = 1 to 16 <NRf> = 1 to 16 ple :CHANNEL:RMATH:CANID:SOURCE 1 :CHANNEL:RMATH:CANID:SOURCE? -> :CHANNEL:RMATH:CANID:SOURCE 1 Description This command is valid on models with the /G3 or

/G5 option.

5 Commands

Function	Sets or queries coefficient C of the currently	Function	Sets or queries the logic signal to analog
	specified real time math operation	i unotion	waveform conversion method (type)
Syntax	·CHANnel <x>·RMATh·CVALue {<nrf>}</nrf></x>	Syntax	:CHANnel <x>:RMATh:DA:TYPE {OBINary]</x>
Oymax	·CHANnel <x>:RMATh·CVALue?</x>	Cyntax	SIGNed UNSigned }
	$\langle x \rangle = 1$ to 16		:CHANnel <x>:RMATh:DA:TYPE?</x>
	<nrf> = -9.9999E+30 to +9.9999E+30</nrf>		<x> = 1 to 16</x>
Evample	CHANNELL'SRMATH.CVALUE +1 0000E+30	Example	:CHANNEL1:RMATH:DA:TYPE OBINARY
Example	CHANNEL1 · RMATH · CVALUE?		:CHANNEL1:RMATH:DA:TYPE?
	-> CHANNEL1 · RMATH·CVALUE +1 0000E+30		-> :CHANNEL1:RMATH:DA:TYPE OBINARY
Description	This command is valid on models with the /G3 or	Description	• This command is valid on models with the /G3
Decomption	/G5 ontion		or /G5 option.
			An execution error will occur if you specify a
· CHANne	1/v>·DM2Th·D22		channel other than that of a logic input module
Function	Oueries all logic signal to analog waveform	CUANDO	
T UNCLION	conversion settings	Eunction	Sets or queries the delay of the specified channel
Suntay	·CHANnel <v>·RMATh·DA?</v>	Suntay	·CHANnel <v>·PMATh·DELaw {CTimes}</v>
Description	This command is valid on models with the /G3	Syntax	·CHANnel <> · NMATH · DELay { < IIme> }
Description	or /G5 option		<pre>channet <x> .NHATH. DEDay : cv> = 1 to 16</x></pre>
	• An execution error will occur if you specify a		$NPf_{2} = 0.0, 0.1$ up to 10 mp
	channel other than that of a logic input module		$\langle NR \rangle = 0.5, 0.1$ ds to 10 llis
			101up to 1mp; 1up
			1 01mg to 10mg; 10ug
: CHANNE	ATTA: BLENGTH (BIT	Example	·CHANNELL·PMATH·DELAV
Length)	Sats or quories the logic signal to analog	Example	CUANNELL. MAIN. DELAT U
I UNCLION	waveform conversion hit longth		CHANNELL, MAIN, DELAL:
Suntay	·CHANnel <v>·PMATh·DA·BIFNath {<ndf>}</ndf></v>	Description	- This command is valid on models with the /C2
Syntax	·CHANNEL X · · · · · DA · BI FNgth ?	Description	• This continuity is valid of models with the /GS
	< x > = 2 to 16		 You cannot set this setting for the channels of
	$NP_{12} = 1 \text{ to } 16$		an installed 16 CH voltage input module 16
Evample	CHANNELL'RMATH DA BLENGTH 16		CH temperature/voltage input module. Jogic
Example	·CHANNEL1 · RMATH·DA · BLENGTH?		input module. CAN bus monitor module. CAN
	-> ·CHANNEL1·RMATH·DA·BLENGTH 16		& LIN bus monitor module, or CAN/CAN ED
Description	This command is valid on models with the /G3		monitor module
Description	or /G5 option.		monitor module.
	An execution error will occur if you specify a	: CHANne	el <x>:RMATh:DVALue</x>
	channel other than that of a logic input module.	Function	Sets or queries coefficient D of the currently
			specified real time math operation.
: CHANne	el <x1>:RMATh:DA:SOURce<x2></x2></x1>	Syntax	:CHANnel <x>:RMATh:DVALue {<nrf>}</nrf></x>
Function	Sets or queries the math source waveform that		:CHANnel <x>:RMATh:DVALue?</x>
	you want to convert into an analog waveform.		<x> = 1 to 16</x>
Syntax	:CHANnel <x>:RMATh:DA:</x>		<nrf> = -9.9999E+30 to +9.9999E+30</nrf>
	SOURce <x2> {<nrf>}</nrf></x2>	Example	CHANNEL1:RMATH:DVALUE +1.0000E+30
	:CHANnel <x>:RMATh:DA:SOURce<x2>?</x2></x>		CHANNEL1:RMATH:DVALUE?
	<x1> = 1 to 16</x1>		-> CHANNEL1:RMATH:DVALUE +1.0000E+30
	<x2> = 1, 2</x2>	Description	This command is valid on models with the /G3 or
Example	:CHANNEL1:RMATH:DA:SOURCE1 1		/G5 option.
	:CHANNEL1:RMATH:DA:SOURCE1?		
	-> :CHANNEL1:RMATH:DA:SOURCE1 1	: CHANne	el <x>:RMATh:ECOunt? (Edge</x>
Description	 This command is valid on models with the /G3 	Count)	
	or /G5 option.	Function	Queries all reset condition settings for the
	You cannot select logic channels of an installed		specified channel's edge count operation.
	CAN bus monitor module, CAN & LIN bus	Syntax	:CHANnel <x>:RMATh:ECOunt?</x>
	monitor module, or CAN/CAN FD monitor	Description	This command is valid on models with the /G3 or
	module.		/G5 option.
	 An execution error will occur if you specify a 	1	

channel other than that of a logic input module.

	or /G5 option.
	 An execution error will occur if you specify a
	channel other than that of a logic input module.
CHANne	l <x>:RMATh:DELay</x>
Inction	Sets or queries the delay of the specified channel.
/ntax	:CHANnel <x>:RMATh:DELay {<time>}</time></x>
	:CHANnel <x>:RMATh:DELay?</x>
	<x> = 1 to 16</x>
	<nrf> = 0 s, 0.1 us to 10 ms</nrf>
	Resolution 0.1us to 100.0us: 0.1us
	101us to 1ms: 1us
	1.01ms to 10ms: 10us
ample	:CHANNEL1:RMATH:DELAY 0
	:CHANNEL1:RMATH:DELAY?
	-> ·CHANNEL1 · RMATH · DELAY ()
ecription	• This command is valid on models with the /G3
scription	or /CE option
	Very compared and their patting for the channels of
	• You cannot set this setting for the channels of
	an Installed 16-CH voltage input module, 16-
	CH temperature/voltage input module, logic
	input module, CAN bus monitor module, CAN
	& LIN bus monitor module, or CAN/CAN FD
	monitor module.
CHANne	l <x>:RMATh:DVALue</x>
Inction	Sets or queries coefficient D of the currently
	specified real time math operation.
/ntax	:CHANnel <x>:RMATh:DVALue {<nrf>}</nrf></x>
	:CHANnel <x>:RMATh:DVALue?</x>
	<x> = 1 to 16</x>
	<nrf> = -9.9999E+30 to +9.9999E+30</nrf>
ample	CHANNEL1:RMATH:DVALUE +1.0000E+30
•	CHANNEL1:RMATH:DVALUE?
	-> CHANNEL1:RMATH:DVALUE +1.0000E+30
escription	This command is valid on models with the /G3 or
20011011	/G5 option
CHANne	l <x>:RMATh:ECOunt? (Edge</x>
ount)	
Inction	Queries all reset condition settings for the
	specified channel's edge count operation.
ntax	:CHANnel <x>:RMATh:ECOunt?</x>
escription	This command is valid on models with the /G3 or

:CHANne ute (Ma	l <x>:RMATh:ECOunt:MRESet:EXEC nual Reset)</x>	: CHANne Function	<pre>l<x>: RMATh : FREQ? Queries all the settings for the specified channel's</x></pre>
Function	Resets the counter of the specified channel's edge count operation.		frequency, period, torque, and edge count (excluding reset) operations.
Syntax	:CHANnel <x>:RMATh:ECOunt:MRESet:EXEC</x>	Syntax Description	:CHANnel <x>:RMATh:FREQ? • This command is valid on models with the /G3</x>
Example	:CHANNEL1:RMATH:ECOUNT:MRESET:EXECU TE	·	or /G5 option. To set the math settings for the frequency.
Description	This command is valid on models with the /G3 or /G5 option.		period, torque, and edge count (excluding reset) operations, use the :CHANnel <x>:RMATh:FREQ</x>
: CHANne	<pre>l<x>:RMATh:ECOunt:OVERange</x></pre>		command and the commands that are lower in
Function	Sets or queries whether the edge count is reset when an over limit occurs for the specified		use the :CHANnel <x>:RMATh:OPERation</x>
Syntax	<pre>channel's edge count operation. :CHANnel<x>:RMATh:ECOunt:</x></pre>		FREQuency, PERiod, or ECOunt. For details on the commands that have different settings
	OVERange { <boolean>} :CHANnel<x>:RMATh:ECOunt:OVERange?</x></boolean>		for the various operations, see the conditions that are written in the command descriptions.
	<x> = 1 to 16</x>		
Example	:CHANNEL1:RMATH:ECOUNT:OVERANGE 1 :CHANNEL1:RMATH:ECOUNT:OVERANGE?	: CHANne Function	l<x>: RMATh : FREQ : BIT</x> Sets or queries the math source waveform (the
Description	This command is valid on models with the /G3 or /G5 ontion		source bit) for the specified channel's frequency, period, torque, and edge count operations (when
:CHANne	1 <x>: RMATh: ECOunt: SRESet</x>	Syntax	<pre>the source is a logic channel). :CHANnel<x>:RMATh:FREQ:BIT {<nrf>}</nrf></x></pre>
(Start	Reset)		:CHANnel <x>:RMATh:FREQ:BIT?</x>
Function	Sets or queries whether the edge count is reset		<x> = 1 to 16</x>
	when the edge count operation starts for the	Evenale	$\langle NRI \rangle = 1 IO 8$
	specified channel.	Example	·CHANNELI.NMATH.FREO.BIT 1
Syntax	:CHANnel <x>:RMATh:ECOunt:</x>		-> :CHANNEL1:RMATH:FREO:BIT 1
	SRESet { <boolean>}</boolean>	Description	This command is valid on models with the /G3 or
	:CHANnel <x>:RMATh:ECOunt:SRESet?</x>	2000.00	/G5 option.
	<x> = 1 to 16</x>		
Example	:CHANNEL1:RMATH:ECOUNT:SRESET 1	: CHANne	<pre>!<x>:RMATh:FREO:DECeleration</x></pre>
	:CHANNELI:RMATH:ECOUNT:SRESET?	Function	Sets or queries whether frequency, period, and
Description	This command is valid on models with the /G3 or		torque, computation's deceleration prediction is turned on.
	/G5 option.	Syntax	:CHANnel <x>:RMATh:FREQ:</x>
			DECeleration { <boolean>}</boolean>
: CHANne Function	Sets or queries coefficient E of the currently		:CHANnel <x>:RMATh:FREQ:DECeleration? <x> = 1 to 16</x></x>
Syntax	:CHANnel <x>:RMATh:EVALue {<nrf>} :CHANnel<x>:RMATh:EVALue?</x></nrf></x>	Example	:CHANNEL1:RMATH:FREQ:DECELERATION ON :CHANNEL1:RMATH:FREQ:DECELERATION? ->
	<x> = 1 to 16 <nrf> = -9.9999E+30 to +9.9999E+30</nrf></x>		:CHANNEL1:RMATH:FREQ: DECELERATION ON
Example	CHANNEL1:RMATH:EVALUE +1.0000E+30 CHANNEL1:RMATH:EVALUE?	Description	This command is valid on models with the /G3 or /G5 option.
Description	-> CHANNEL1:RMATH:EVALUE +1.0000E+30 This command is valid on models with the /G3 or /G5 option.		

	1 <x>: RMATh: FREQ: HYSTeresis</x>
FUNCTION	sets of queries the detection hysteresis for the
	edge count operations
Suntay	· CHANDOLCKY, DMATH, FREO,
Syntax	UNSTOROGIC (HICHLIONIMIDDIE)
	- CUANDOL CUCK - DMARD - EDEC - UVCROPORT
	<pre>:CHANNEL X /: RMAIN: FREQ: HISTELESIS: /// = 1 to 16</pre>
Evampla	-X I IO IO
Example	CUANNELL PRATH. FREQ. HISTERESIS HIGH
	CHANNELI: KMAIN: FREQ: HISIERESIS:
	-/ :CHANNELI:RMAIN:FREQ:
Description	This command is valid on models with the (C2 or
Description	/G5 option.
: CHANne	l <x>:RMATh:FREQ:LEVel</x>
Function	Sets or queries the detection level for the
	specified channel's frequency, period, torque, and
	edge count operations.
Syntax	:CHANnel <x>:RMATh:FREQ:</x>
	LEVel { <voltage> <nrf> <current>}</current></nrf></voltage>
	:CHANnel <x>:RMATh:FREQ:LEVel?</x>
	<x> = 1 to 16</x>
Example	:CHANNEL1:RMATH:FREQ:LEVEL 1
	:CHANNEL1:RMATH:FREQ:LEVEL?
	-> :CHANNEL1:RMATH:FREQ:
	LEVEL 1.000000E+00
Description	This command is valid on models with the /G3 or /G5 option.
: CHANne	l <x>:RMATh:FREQ:OFFSet</x>
Function	Sets or queries the frequency/period calculation offset.
Syntax	:CHANnel <x>:RMATh:FREQ:OFFSet {<nrf>}</nrf></x>
	:CHANnel <x>:RMATh:FREQ:OFFSet?</x>
	<x> = 1 to 16</x>
	<nrf> = -9.9999E+30 to +9.9999E+30</nrf>
Description	This command is valid on models with the /G3 or /G5 option.
:CHANne	l <x>:RMATh:FREQ:PROTate (Pulse</x>
per Rot	ate)
Function	Sets or queries the number of pulses per rotation
Currenteria	for the specified channels frequency operation.
Syntax	:CHANNEL <x>:RMATH:FREQ:</x>
	<pre>rkUidle {\NKL?}</pre>
Evores!-	CHANNEL1. DMARU- EDEC. DDCTATE?
Example	CHANNELL: KMATH: FREQ: PROTATE 180
	CHANNELL: KMATH: FKEQ: PROTATE?
	-> :CHANNELI:RMATH:FREQ:PROTATE 180

: CHANne Function	1 <x>: RMATh : FREQ : SCALe Sets or queries the scale of the specified</x>
Syntax	CHANnel <s frequency="" operation.<="" td=""></s>
Cyntax	COMPANY INTERIOR
	CUANTER A CONTRACT OF A CONTRA
	<pre>:CHANNEL<x>:RMATH:FREQ:SCALE? <x> = 1 to 16</x></x></pre>
Example	:CHANNEL1:RMATH:FREQ:SCALE HZ
	:CHANNEL1:RMATH:FREQ:SCALE?
	-> :CHANNEL1:RMATH:FREQ:SCALE HZ
Description	This command is valid on models with the /G3 or /G5 option.
: CHANne	1 <x>:RMATh:FREQ:SLOPe</x>
Function	Sets or queries the detection slope for the
	specified channel's frequency, period, torque, and
	edge count operations.
Syntax	:CHANnel <x>:RMATh:FREQ:</x>
	SLOPe {RISE FALL}
	:CHANnel <x>:RMATh:FREQ:SLOPe?</x>
	<x> = 1 to 16</x>
Example	:CHANNEL1:RMATH:FREQ:SLOPE RISE
	:CHANNEL1:RMATH:FREQ:SLOPE?
	-> :CHANNEL1:RMATH:FREQ:SLOPE RISE
Description	This command is valid on models with the /G3 or /G5 option
Function	Sets or queries the math source waveform for the specified channel's frequency, period, torque, and edge count operations.
Syntax	:CHANnel <x>:RMATh:FREQ:</x>
-)	SOURce { <nrf>[,<nrf>]}</nrf></nrf>
	:CHANnel <x>:RMATh:FREO:SOURce?</x>
	<x> = 1 to 16</x>
Example	:CHANNEL1:RMATH:FRE0:SOURCE 1
	:CHANNEL1:RMATH:FRE0:SOURCE?
	-> :CHANNEL1:RMATH:FRE0:SOURCE 1
Description	This command is valid on models with the /G3 or
Description	/G5 option.
: CHANne	1 <x>:RMATh:FREO:STOPpredict</x>
Function	Sets or gueries whether frequency, torque, and
	period computation's stop prediction is turned on
Syntax	:CHANnel <x>:RMATh:FREO:</x>
oymax	STOPpredict { <nrf>LOFF}</nrf>
	·CHANnel <x>·RMATh·FREO·STOPpredict?</x>
	<pre>commence <p< td=""></p<></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre>
	<pre></pre>
F	<nri> = 2, 4, 8, 10</nri>
∟xample	:CHANNELI:RMATH:FREQ:STOPPREDICT OFF
	ANANANA 1 AVA MA ANA ANA ANA ANA ANA ANA ANA ANA ANA
	:CHANNEL1:RMATH:FREQ:STOPPREDICT?
	:CHANNEL1:RMATH:FREQ:STOPPREDICT? -> :CHANNEL1:RMATH:FREQ:
	:CHANNEL1:RMATH:FREQ:STOPPREDICT? -> :CHANNEL1:RMATH:FREQ: STOPPREDICT OFF

: CHANne	el <x1>:RMATh:IFILter?</x1>	: CHANne	el <x1>:RMATh:IFILter:CFRequen</x1>
Function	Queries all IIR filter operation settings.	су	
Syntax	:CHANnel <x1>:RMATh:IFILter?</x1>	Function	Sets or queries the center frequency of the
	<x1> = 1 to 16</x1>		bandpass filter of the IIR filter operation.
Description	This command is valid on models with the /G3 or	Syntax	:CHANnel <x1>:RMATh:IFILter:CFRequen</x1>
	/G5 option.		cy { <frequency>}</frequency>
			<x1> = 1 to 16</x1>
: CHANne	el <x1>:RMATh:IFILter:BAND</x1>		<frequency>:</frequency>
Function	Sets or queries the band of the IIR filter operation.		Range: 60 Hz to 3 MHz
Syntax	:CHANnel <xl>:RMATh:IFILter:</xl>		Resolution:
	BAND {BPASS HPASS LPASS}		20 HZ (60 HZ to 1.18 KHZ)
Evennele	<x1> = 1 [0 16</x1>		200 HZ (1.2 KHZ to 11.8 KHZ)
Example	CHANNELI:RMATH:IFILTER:BAND BPASS		2 KHZ (12 KHZ to 118 KHZ)
	-> .CUANNEL1.EMAIN: IFILIEK: DAND?	Example	20 KHZ (120 KHZ 10 3 WHZ)
	-> :CHANNELI:RMAIH:IFILIER:	Example	CERECUENCY 10047
Description	This command is valid on models with the /C3 or		·CHANNELI.OMATH.ITIITED.CEDEOUENCV2
Description	/G5 option		-> ·CHANNELI.PRATH.IFILIER.CFREQUENCI:
			CERECUENCY 100Hz
. (113)]		Description	This command is valid on models with the /G3 or
Eunction	Sets or queries the cutoff frequency of the UP	Description	/G5 option
1 unction	filter operation		
Syntax	·CHANnel <x1>·RMATh·IFILter·</x1>	CHANDO	1/v1/.DMATH.TETT + ar. DRANd
Oyntax	CUToff { <frequency>}</frequency>	Function	Sets or queries the bandwidth of the bandpass
	<x1> = 1 to 16</x1>	i unouon	filter of the IIR filter operation
	<frequency>:</frequency>	Syntax	:CHANnel <x1>:RMATh:IFILter:</x1>
	When BAND is set to LPASs	C y	PBANd { <frequency>}</frequency>
	Range: 0.2 Hz to 3 MHz		<x1> = 1 to 16</x1>
	Resolution:		<pre><frequency> = 2 MHz. 1.5 MHz. 1 MHz.</frequency></pre>
	0.2 Hz (0.2 Hz to 29.8 Hz)		500 kHz, 200 kHz, 150 kHz, 100 kHz,
	2 Hz (30 Hz to 298 Hz)		50 kHz, 20 kHz, 15 kHz, 10 kHz,
	20 Hz (300 Hz to 2.98 kHz)		5 kHz, 2 kHz, 1.5 kHz, 1 kHz,
	200 Hz (3 kHz to 29.8 kHz)		500 Hz, 200 Hz, 100 Hz
	2 kHz (30 kHz to 298 kHz)	Example	:CHANNEL1:RMATH:IFILTER:PBAND 100Hz
	20 kHz (300 kHz to 3 MHz)		:CHANNEL1:RMATH:IFILTER:PBAND?
	When BAND is set to HPASs		-> :CHANNEL1:RMATH:IFILTER:
	Range: 20 Hz to 3 MHz		PBAND 100Hz
	Resolution:	Description	This command is valid on models with the /G3 or
	20 Hz (20 Hz to 2.98 kHz)		/G5 option.
	200 Hz (3 kHz to 29.8 kHz)		
	2 kHz (30 kHz to 298 kHz)	: CHANne	el <x1>:RMATh:IFILter:INTerpo</x1>
	20 kHz (300 kHz to 3 MHz)	Function	Sets or queries whether interpolation is used with
Example	:CHANNEL1:RMATH:IFILTER:CUTOFF 100Hz		the IIR filter operation.
	:CHANNEL1:RMATH:IFILTER:CUTOFF?	Syntax	:CHANnel <x1>:RMATh:IFILter:</x1>
	-> :CHANNEL1:RMATH:IFILTER:		INTerpo { <boolean>}</boolean>
	CUTOFF 100Hz		<x1> = 1 to 16</x1>
Description	This command is valid on models with the /G3 or	Example	:CHANNEL1:RMATH:IFILTER:INTERPO ON
	/G5 option.		:CHANNEL1:RMATH:IFILTER:INTERPO?
			-> :CHANNEL1:RMATH:IFILTER:
			INTERPO ON
		Description	This command is valid on models with the /G3 or
			/G5 option.
		1	

: CHANne Function	I<x>: RMATh : INTegral?</x> Queries all integration settings of the specified
Syntax	:CHANnel <x>:RMATh:INTegral?</x>
•	<x> = 1 to 16</x>
Description	This command is valid on models with the /G3 or /G5 option.
:CHANne	l <x>:RMATh:INTegral:MRESet:EX</x>
ECute (Manual Reset)
Function	Resets the integrated value of the specified channel.
Syntax	:CHANnel <x>:RMATh:INTegral:MRESet:EX</x>
Example	:CHANNEL1:RMATH:INTEGRAL:MRESET:EXEC
Description	This command is valid on models with the /G3 or /G5 option.
: CHANne Function	Sets or queries whether the integrated value is reset when an over limit occurs for the specified
Syntax	<pre>channel. :CHANnel<x>:RMATh:INTegral:</x></pre>
	<pre>OVERange {<boolean>} :CHANnel<x>:RMATh:INTegral:OVERange? <x> = 1 to 16</x></x></boolean></pre>
Example	:CHANNEL1:RMATH:INTEGRAL:OVERRANGE 1 :CHANNEL1:RMATH:INTEGRAL:OVERRANGE? -> :CHANNEL1:RMATH:INTEGRAL: OVERRANGE 1
Description	This command is valid on models with the /G3 or /G5 option.
: CHANne	l <x>:RMATh:INTegral:SRESet</x>
(Start	Reset)
Function	Sets or queries whether the integrated value is reset when integration starts for the specified
Syntax	<pre>channel. :CHANnel<x>:RMATh:INTegral: SRESet {<boolean>}</boolean></x></pre>
	:CHANnel <x>:RMATh:INTegral:SRESet?</x>
Evample	<pre><x> = I to io ·CHANNEL1·RMATH·INTEGRAL·SRESET 1</x></pre>
Example	:CHANNEL1:RMATH:INTEGRAL:SRESET?
	-> :CHANNEL1:RMATH:INTEGRAL:SRESET 1
Description	This command is valid on models with the /G3 or /G5 option.
: CHANne	l <x>:RMATh:INTegral:ZRESet?</x>
Function	Queries all settings related to the integrated
	value being reset when the signal crosses zero in integration of the specified channel
Svntax	:CHANnel <x>:RMATh:INTegral:ZRESet?</x>
Description	This command is valid on models with the /G3 or /G5 option.

s Sets or queries the hysteresis that is used for
Sets or queries the hysteresis that is used for
resetting the integrated value when the signal
crosses zero for the specified channel.
:CHANnel <x>:RMATh:INTegral:ZRESet:HY</x>
STeresis {LOW HIGH MIDDle}
:CHANnel <x>:RMATh:INTegral:ZRESet:HY</x>
STeresis?
<x> = 1 to 16</x>
:CHANNEL1:RMATH:INTEGRAL:ZRESET LOW
:CHANNEL1:RMATH:INTEGRAL:ZRESET?
-> :CHANNEL1:RMATH:INTEGRAL:
ZRESET LOW
This command is valid on models with the /G3 or
/G5 option.
l <x>:RMATh:INTegral:ZRESet:MO</x>
Sets or queries whether the integrated value
is reset when the signal crosses zero for the
specified channel.
:CHANnel <x>:RMATh:INTegral:ZRESet:MO</x>
DE { <boolean>}</boolean>
:CHANnel <x>:RMATh:INTegral:ZRESet:MO</x>
DE?
<x> = 1 to 16</x>
:CHANNEL1:RMATH:INTEGRAL:ZRESET: MODE 1
:CHANNEL1:RMATH:INTEGRAL:ZRESET:
MODE ?
HODE:
-> :CHANNEL1:RMATH:INTEGRAL:ZRESET:
-> :CHANNEL1:RMATH:INTEGRAL:ZRESET: MODE 1
 -> :CHANNEL1:RMATH:INTEGRAL:ZRESET: MODE 1 This command is valid on models with the /G3 or /G5 ontion
 -> :CHANNEL1:RMATH:INTEGRAL:ZRESET: MODE 1 This command is valid on models with the /G3 or /G5 option.
<pre>-> :CHANNEL1:RMATH:INTEGRAL:ZRESET: MODE 1 This command is valid on models with the /G3 or /G5 option. l<x>:RMATh:INTegral:ZRESet:SL</x></pre>
 -> :CHANNEL1:RMATH:INTEGRAL:ZRESET: MODE 1 This command is valid on models with the /G3 or /G5 option. 1<x>:RMATh:INTegral:ZRESet:SL</x> Sets or queries the slope that is used for resetting
 -> :CHANNEL1:RMATH:INTEGRAL:ZRESET: MODE 1 This command is valid on models with the /G3 or /G5 option. 1<x>:RMATh:INTegral:ZRESet:SL</x> Sets or queries the slope that is used for resetting the integrated value when the signal crosses zero
 -> :CHANNEL1:RMATH:INTEGRAL:ZRESET: MODE 1 This command is valid on models with the /G3 or /G5 option. 1<x>:RMATh:INTegral:ZRESet:SL</x> Sets or queries the slope that is used for resetting the integrated value when the signal crosses zero for the specified channel.
 -> :CHANNEL1:RMATH:INTEGRAL:ZRESET: MODE 1 This command is valid on models with the /G3 or /G5 option. I<x>:RMATh:INTegral:ZRESet:SL</x> Sets or queries the slope that is used for resetting the integrated value when the signal crosses zero for the specified channel. :CHANNEL
<pre>-> :CHANNEL1:RMATH:INTEGRAL:ZRESET: MODE 1 This command is valid on models with the /G3 or /G5 option. l<x>:RMATh:INTegral:ZRESet:SL Sets or queries the slope that is used for resetting the integrated value when the signal crosses zero for the specified channel. :CHANnel<x>:RMATh:INTegral:ZRESet:SL OPe {FALL/RISE}</x></x></pre>
<pre>-> :CHANNEL1:RMATH:INTEGRAL:ZRESET: MODE 1 This command is valid on models with the /G3 or /G5 option. l<x>:RMATh:INTegral:ZRESet:SL Sets or queries the slope that is used for resetting the integrated value when the signal crosses zero for the specified channel. :CHANNel<x>:RMATh:INTegral:ZRESet:SL OPe {FALL RISE} :CHANNel<x>:RMATh:INTegral:ZRESet:SL</x></x></x></pre>
<pre>>> :CHANNEL1:RMATH:INTEGRAL:ZRESET: MODE 1 This command is valid on models with the /G3 or /G5 option. l<x>:RMATh:INTegral:ZRESet:SL Sets or queries the slope that is used for resetting the integrated value when the signal crosses zero for the specified channel. :CHANnel<x>:RMATh:INTegral:ZRESet:SL OPe {FALL RISE} :CHANnel<x>:RMATh:INTegral:ZRESet:SL OPe ?</x></x></x></pre>
<pre>>> :CHANNEL1:RMATH:INTEGRAL:ZRESET: MODE 1 This command is valid on models with the /G3 or /G5 option. l<x>:RMATh:INTegral:ZRESet:SL Sets or queries the slope that is used for resetting the integrated value when the signal crosses zero for the specified channel. :CHANnel<x>:RMATh:INTegral:ZRESet:SL OPe {FALL RISE} :CHANnel<x>:RMATh:INTegral:ZRESet:SL OPe? <x> = 1 to 16</x></x></x></x></pre>
<pre>>> :CHANNEL1:RMATH:INTEGRAL:ZRESET: MODE 1 This command is valid on models with the /G3 or /G5 option. l<x>:RMATh:INTegral:ZRESet:SL Sets or queries the slope that is used for resetting the integrated value when the signal crosses zero for the specified channel. :CHANnel<x>:RMATh:INTegral:ZRESet:SL OPe {FALL RISE} :CHANnel<x>:RMATh:INTegral:ZRESet:SL OPe? <x> = 1 to 16 :CHANNEL1:RMATH:INTEGRAL:ZRESET:</x></x></x></x></pre>
<pre>>> :CHANNEL1:RMATH:INTEGRAL:ZRESET: MODE 1 This command is valid on models with the /G3 or /G5 option. I<x>:RMATh:INTegral:ZRESet:SL Sets or queries the slope that is used for resetting the integrated value when the signal crosses zero for the specified channel. :CHANnel<x>:RMATh:INTegral:ZRESet:SL OPe {FALL RISE} :CHANnel<x>:RMATh:INTegral:ZRESet:SL OPe? <x> = 1 to 16 :CHANNEL1:RMATH:INTEGRAL:ZRESET: SLOPE FALL</x></x></x></x></pre>
<pre>>> :CHANNEL1:RMATH:INTEGRAL:ZRESET: MODE 1 This command is valid on models with the /G3 or /G5 option. l<x>:RMATh:INTegral:ZRESet:SL Sets or queries the slope that is used for resetting the integrated value when the signal crosses zero for the specified channel. :CHANnel<x>:RMATh:INTegral:ZRESet:SL OPe {FALL RISE} :CHANnel<x>:RMATh:INTegral:ZRESet:SL OPe? <x> = 1 to 16 :CHANNEL1:RMATH:INTEGRAL:ZRESET: SLOPE FALL :CHANNEL1:RMATH:INTEGRAL:ZRESET:</x></x></x></x></pre>
<pre>>> :CHANNEL1:RMATH:INTEGRAL:ZRESET: MODE 1 This command is valid on models with the /G3 or /G5 option. l<x>:RMATh:INTegral:ZRESet:SL Sets or queries the slope that is used for resetting the integrated value when the signal crosses zero for the specified channel. :CHANnel<x>:RMATh:INTegral:ZRESet:SL OPe {FALL RISE} :CHANnel<x>:RMATh:INTegral:ZRESet:SL OPe? <x> = 1 to 16 :CHANNEL1:RMATH:INTEGRAL:ZRESET: SLOPE FALL :CHANNEL1:RMATH:INTEGRAL:ZRESET: SLOPE?</x></x></x></x></pre>
<pre>-> :CHANNEL1:RMATH:INTEGRAL:ZRESET: MODE 1 This command is valid on models with the /G3 or /G5 option. l<x>:RMATh:INTegral:ZRESet:SL Sets or queries the slope that is used for resetting the integrated value when the signal crosses zero for the specified channel. :CHANNel<x>:RMATh:INTegral:ZRESet:SL OPe {FALL RISE} :CHANNEL<x>:RMATh:INTegral:ZRESet:SL OPe ? <x> = 1 to 16 :CHANNEL1:RMATH:INTEGRAL:ZRESET: SLOPE FALL :CHANNEL1:RMATH:INTEGRAL:ZRESET: SLOPE? -> :CHANNEL1:RMATH.INTEGRAL:ZRESET.</x></x></x></x></pre>
<pre>>> :CHANNEL1:RMATH:INTEGRAL:ZRESET: MODE 1 This command is valid on models with the /G3 or /G5 option. l<x>:RMATh:INTegral:ZRESet:SL Sets or queries the slope that is used for resetting the integrated value when the signal crosses zero for the specified channel. :CHANnel<x>:RMATh:INTegral:ZRESet:SL OPe {FALL RISE} :CHANnel<x>:RMATh:INTegral:ZRESet:SL OPe? <x> = 1 to 16 :CHANNEL1:RMATH:INTEGRAL:ZRESET: SLOPE FALL :CHANNEL1:RMATH:INTEGRAL:ZRESET: SLOPE? -> :CHANNEL1:RMATH:INTEGRAL:ZRESET:</x></x></x></x></pre>
<pre>-> :CHANNEL1:RMATH:INTEGRAL:ZRESET: MODE 1 This command is valid on models with the /G3 or /G5 option. l<x>:RMATh:INTegral:ZRESet:SL Sets or queries the slope that is used for resetting the integrated value when the signal crosses zero for the specified channel. :CHANNel<x>:RMATh:INTegral:ZRESet:SL OPe {FALL RISE} :CHANNel<x>:RMATh:INTegral:ZRESet:SL OPe? <x> = 1 to 16 :CHANNEL1:RMATH:INTEGRAL:ZRESET: SLOPE FALL :CHANNEL1:RMATH:INTEGRAL:ZRESET: SLOPE? -> :CHANNEL1:RMATH:INTEGRAL:ZRESET: SLOPE FALL</x></x></x></x></pre>

:CHANnel <x>:RMATh:KNOCkflt?</x>			
Function	Queries all knocking filter settings of the specified		
	channel.		
Syntax	:CHANnel <x>:RMATh:KNOCkflt?</x>		
Description	This command is valid on DL850EVs with the /G3		
	or /G5 option.		
:CHANne	l <x>:RMATh:KNOCkflt:DIFFerent</x>		
Function	Sets or queries the differentiation on/off status of		
	the specified channel's knocking filter		
Syntax	:CHANnel <x>:RMATh:KNOCkflt:DIFFerent</x>		
oynan	<pre>ial {<boolean>}</boolean></pre>		
	:CHANnel <x>:RMATh:KNOCkflt:DIFFerent</x>		
	ial?		
	<x> = 1 to 16</x>		
Example	:CHANNEL1:RMATH:KNOCKFLT:		
	DIFFERENTIAL 1		
	:CHANNEL1:RMATH:KNOCKFLT:		
	DIFFERENTIAL?		
	-> :CHANNEL1:RMATH:KNOCKFLT:		
	DIFFERENTIAL 1		
Description	This command is valid on DL850EVs with the /G3		
	or /G5 option.		
: CHANne	l <x>:RMATh:KNOCkflt:ELEVel</x>		
Function	Sets or queries the elimination level of the		
	specified channel's knocking filter.		
Syntax	:CHANnel <x>:RMATh:KNOCkflt:</x>		
	ELEVel { <voltage> <current> <nrf>}</nrf></current></voltage>		
	:CHANnel <x>:RMATh:KNOCkfltinaiton:EL</x>		
	EVel?		
	<x> = 1 to 16</x>		
Example	:CHANNEL1:RMATH:KNOCKFLT:ELEVEL 1		
	:CHANNEL1:RMATH:KNOCKFLT:ELEVEL?		
	-> :CHANNEL1:RMATH:KNOCKFLT:		
	ELEVEL 1.000000E+00		
Description	This command is valid on DL850EVs with the /G3		
	or /G5 option.		
:CHANne	l <x>:RMATh:LABel</x>		
Function	Sets or queries the label of the specified RMath		
	channel (the specified channel when real time		
a <i>i</i>	math is turned on).		
Syntax	:CHANnel <x>:RMATh:LABel {<string>}</string></x>		
	<x> = 1 t0 16</x>		
E	<string> = Up to 16 characters</string>		
⊨xample	CHANNELI: KMATH: LABEL "TRACE3"		
	CHANNELL: KMATH: LABEL!		
Description	This command is valid on models with the /C3 or		
Description	/G5 option		

:CHANnel<x>:RMATh:MAVG (Moving Average) Function Sets or queries the on/off status of the mean of the specified RMath channel (the specified channel when real time math is turned on). Syntax :CHANnel<x>:RMATh:MAVG {<Boolean>} <x> = 1 to 16 :CHANNEL1:RMATH:MAVG 1 Example :CHANNEL1:RMATH:MAVG? -> :CHANNEL1:RMATH:MAVG 1 Description This command is valid on models with the /G3 or /G5 option. :CHANnel<x>:RMATh:MODE Function Sets or queries the real time math on/off status of the specified channel. Syntax :CHANnel<x>:RMATh:MODE {<Boolean>} :CHANnel<x>:RMATh:MODE? <x> = 1 to 16 Example :CHANNEL1:RMATH:MODE 1 :CHANNEL1:RMATH:MODE? -> :CHANNEL1:RMATH:MODE 1 Description • This command is valid on models with the /G3 or /G5 option. · You cannot set this setting to ON for the channels of an installed 16-CH voltage input module, 16-CH temperature/voltage input module, CAN bus monitor module, CAN & LIN bus monitor module, or CAN/CAN FD monitor module. :CHANnel<x>:RMATh:OFFSet Sets or queries the offset of the specified RMath Function channel (the specified channel when real time math is turned on). :CHANnel<x>:RMATh:OFFSet {<NRf>} Syntax <x> = 1 to 16 Example :CHANNEL1:RMATH:OFFSET 1 :CHANNEL1:RMATH:OFFSET? -> :CHANNEL1:RMATH:OFFSET 1 Description This command is valid on models with the /G3 or /G5 option.

:CHANnel<x>:RMATh:OPERation

Function	Sets or queries the operation of the specified real
1 unction	time math channel
Suptor	CUANNal CHAINEL
Syntax	MINUS MULTIN S DIVISE ACTON (FLOS)
	FPLus FMINUS FMOLCIPIE FDIVIDE INTI
	INT2 POLYNOMIAI SQRTI SQRT2 LOGI
	LOG2 RANGLE SIN COS ATAN RMS POWEr
	PIN'l'egral DA KNOCkilt ERANGle PASub
	FREQuency PERiod ECOunt RESolver
	IFILter PWM RPOWer CANId TORQue
	AMINus TPResolver}
	:CHANnel <x>:RMATh:OPERation?</x>
	<x> = 1 to 16</x>
Example	:CHANNEL1:RMATH:OPERATION PLUS
	:CHANNEL1:RMATH:OPERATION?
	-> :CHANNEL1:RMATH:OPERATION PLUS
Description	This command is valid on models with the /G3 or
	/G5 option.
: CHANne	l <x>:RMATh:OPTimize</x>
Function	Optimizes the vertical scale of the specified
	channel that will be used in real time math.
Syntax	:CHANnel <x>:RMATh:OPTimize</x>
	<x> = 1 to 16</x>
Example	:CHANNEL1:RMATH:OPTIMIZE
Description	This command is valid on models with the /G3 or
	/G5 option.
: CHANne	l <x>:RMATh:PASub:SIGN</x>
Function	Sets or queries the signs of the sources for the
	polynomial with a coefficient operation of the
	specified channel.
Syntax	:CHANnel <x>:RMATh:PASub:SIGN</x>
2	{MINus PLUS}[,{MINus PLUS}][,{MINus
	PLUS}][,{MINus PLUS}]
	:CHANnel <x>:RMATh:PASub:SIGN?</x>
	<x> = 1 to 16</x>
Example	:CHANNEL1:RMATH:PASUB:SIGN PLUS
	:CHANNEL1:RMATH:PASUB:SIGN?
	-> :CHANNEL1:RMATH:PASUB:SIGN PLUS
Description	This command is valid on models with the /G3 or
Decomption	/G5 ontion
	1 / why a by DINMA and 1 0
Eunction	Oueries all effective nower integrat:
	the specified channel
Cuntor	
Syniax	. CHANNELXX/: KMAIN: PINTEGIAL?

:CHANne	l <x>:RMATh:PINTegral:MRESet:H</x>
Function	Resets the effective nower integration of the
1 unction	specified channel
Syntax	·CHANnel <x>·RMATh·PINTegral·MRESet·</x>
-)	XECute
	<x> = 1 to 16</x>
Example	:CHANNEL1:RMATH:PINTEGRAL:MRESET:
	EXECUTE
Description	This command is valid on models with the /G3 c
	/G5 option.
: CHANne Function	l<x>: RMATh : PINTegral : OVERange</x> Sets or queries whether the integrated power value of the specified channel is reset when an over limit occurs during effective power
	integration.
Syntax	:CHANnel <x>:RMATh:PINTegral:</x>
	OVERange { <boolean>}</boolean>
	:CHANnel <x>:RMATh:PINTegral:OVERan</x>
	ge?
	<x> = 1 to 16</x>
Example	:CHANNEL1:RMATH:PINTEGRAL:
	OVERRANGE 1
	:CHANNEL1:RMATH:PINTEGRAL:OVERRANGE
	-> :CHANNEL1:RMATH:PINTEGRAL:
	OVERRANGE 1
Description	This command is valid on models with the /G3 o
	/G5 option.
: CHANne	1 <x>: RMATh : PINTegral : SCALe</x>
: CHANne Function	1<x>: RMATh : PINTegral : SCALe</x> Sets the reference time for the effective power integration of the specified channel
: CHANne Function	1<x>: RMATh : PINTegral : SCALe</x> Sets the reference time for the effective power integration of the specified channel.
: CHANne Function Syntax	<pre>l<x>: RMATh : PINTegral : SCALe Sets the reference time for the effective power integration of the specified channel. :CHANnel<x>: RMATh : PINTegral : SCALE _ HOUR SECond }</x></x></pre>
: CHANne Function Syntax	<pre>l<x>: RMATh : PINTegral : SCALe Sets the reference time for the effective power integration of the specified channel. :CHANnel<x>: RMATh : PINTegral : SCALe {HOUR SECond} :CHANnel<x>: RMATh : PINTegral : SCALe ?</x></x></x></pre>
: CHANne Function Syntax	<pre>l<x>: RMATh : PINTegral : SCALe Sets the reference time for the effective power integration of the specified channel. :CHANnel<x>: RMATh : PINTegral : SCALe {HOUR SECond} :CHANnel<x>: RMATh : PINTegral : SCALe?</x></x></x></pre>
: CHANne Function Syntax	<pre>l<x>: RMATh : PINTegral : SCALe Sets the reference time for the effective power integration of the specified channel. :CHANnel<x>: RMATh : PINTegral : SCALe {HOUR SECond} :CHANnel<x>: RMATh : PINTegral : SCALe? <x> = 1 to 16 .CHANNEL1 : RMATH : PINTEGRAL : SCALE HOUR </x></x></x></x></pre>
: CHANne Function Syntax Example	<pre>l<x>: RMATh : PINTegral : SCALe Sets the reference time for the effective power integration of the specified channel. :CHANnel<x>:RMATh:PINTegral: SCALe {HOUR SECond} :CHANnel<x>:RMATh:PINTegral:SCALe? <x> = 1 to 16 :CHANNEL1:RMATH:PINTEGRAL:SCALE HOU :CHANNEL1:RMATH:PINTEGRAL:SCALE</x></x></x></x></pre>
: CHANne Function Syntax Example	<pre>l<x>: RMATh : PINTegral : SCALe Sets the reference time for the effective power integration of the specified channel. :CHANnel<x>:RMATh:PINTegral: SCALe {HOUR SECond} :CHANnel<x>:RMATh:PINTegral:SCALe? <x> = 1 to 16 :CHANNEL1:RMATH:PINTEGRAL:SCALE HOU :CHANNEL1:RMATH:PINTEGRAL:SCALE -> :CHANNEL1:RMATH:PINTEGRAL:SCALE</x></x></x></x></pre>

Description This command is valid on models with the /G3 or /G5 option.

: CHANne Function	l <x>: RMATh : PINTegral : SRESet Sets or queries whether the integrated value is</x>	
	reset when the effective power integration starts	
	for the specified channel.	
Syntax	:CHANnel <x>:RMATh:PINTegral:</x>	
	SRESet { <boolean>}</boolean>	
	:CHANnel <x>:RMATh:PINTegral:SRESet?</x>	
	<x> = 1 to 16</x>	
Example	:CHANNELI:RMATH:PINTEGRAL:SRESET I	
	:CHANNELI:RMATH:PINTEGRAL:SRESET?	
	-> :CHANNELI:RMATH:PINTEGRAL: SRESET 1	
Description	This command is valid on models with the /G3 or	
	/G5 option.	
:CHANne	1 <x>:RMATh:POSition</x>	
Function	Sets or queries the vertical position of the	
	specified RMath channel (the specified channel	
	when real time math is turned on).	
Svntax	:CHANnel <x>:RMATh:POSition {<nrf>}</nrf></x>	
-)	:CHANnel <x>:RMATh:POSition?</x>	
	<x> = 1 to 16</x>	
	<nrf> = -5.00 to +5.00 (div; in steps of 0.01 div)</nrf>	
Example	:CHANNEL1:RMATH:POSITION 2.00	
	:CHANNEL1:RMATH:POSITION?	
	-> :CHANNEL1:RMATH:POSITION 2.00	
Description	This command is valid on models with the /G3 or	
	/G5 option.	
:CHANne	l <x>:RMATh:POWer?</x>	
Function	Queries all effective power calculation period	
	settings of the specified channel.	
Svntax	:CHANnel <x>:RMATh:POWer?</x>	
Description	This command is valid on models with the /G3 or	
	/G5 option.	
·CHANne		
Function	Sets or queries the effective power calculation	
	period's edge detection math source waveform	
	(detection bit) of the specified channel (when a	
	logic channel is being used as the edge detection	
	channel).	
Svntax	:CHANnel <x>:RMATh:POWer:TERM:</x>	
-)	EBIT { <nrf>}</nrf>	
	:CHANnel <x>:RMATh:POWer:TERM:EBIT?</x>	
	<x> = 1 to 16</x>	
	<nrf> = 1 to 8</nrf>	
Example	:CHANNELL:RMATH:POWER:TERM:EBIT 1	
	:CHANNEL1:RMATH:POWER:TERM:EBTT?	
	-> :CHANNEL1:RMATH:POWER:TERM:EBIT 1	
Description	This command is valid on models with the /G3	
	or /G5 option	
	This setting is shared with the	
	:CHANnel <x>:RMATh:RMS command</x>	

:CHANNE	1 <x>:RMATH:POWEr:TERM:EHISter</x>
Function	Sets or queries the effective power calculation
	period's detection hysteresis of the specified
	channel.
Syntax	:CHANnel <x>:RMATh:POWer:TERM:EHYSter</x>
5	esis {HIGH LOW MIDDle}
	:CHANnel <x>:RMATh:POWer:TERM:EHYSter</x>
	esis?
	<x> = 1 to 16</x>
Example	:CHANNEL1:RMATH:POWER:TERM:
	EHYSTERESIS HIGH
	:CHANNEL1:RMATH:POWER:TERM:
	EHYSTERESIS?
	-> :CHANNEL1:RMATH:POWER:TERM:
	EHYSTERESIS HIGH
Description	• This command is valid on models with the /G3
	or /G5 option.
	 This setting is shared with the
	:CHANnel <x>:RMATh:RMS command.</x>
:CHANne	l <x>:RMATh:POWer:TERM:ELEVel</x>
Function	Sets or queries the effective power calculation
_	period's detection level of the specified channel.
Syntax	:CHANnel <x>:RMATh:POWer:TERM:</x>
	ELEVel { <voltage> <nrf> <current>}</current></nrf></voltage>
	:CHANnel <x>:RMATh:POWer:TERM:ELEVel?</x>
	<x> = 1 to 16</x>
Example	:CHANNEL1:RMATH:POWER:TERM:ELEVEL 1
	:CHANNELI:RMATH:POWER:TERM:ELEVEL? ->
	:CHANNELI:RMATH:POWER:TERM:
Description	ELEVEL 1.000000E+00
Description	• This command is valid on models with the /G3
	or /G5 option.
	Inis setting is shared with the
	:CHANnel <x>:RMAIn:RMS command.</x>
CHANDO	
Function	Sets or queries the effective nower calculation
1 unction	neriod's detection slope of the specified channel
Syntax	·CHANnel <x>·RMATh·POWer·TERM·</x>
Syntax	ESLope {BIS]ope FALL BISE}
	·CHANnel <x>·RMATh·POWer·TERM·ESLope?</x>
	< > = 1 to 16
Evample	·CHANNELI · RMATH· POWER·TERM·
Livample	ESLOPE FALL
	·CHANNEL1 · RMATH · POWER · TERM · ESLOPE?
	-> ·CHANNELLI·RMATH·DOWER·TERM·
	ESLOPE FALL
Description	This command is valid on models with the IC2
Description	or /G5 option
	 This setting is shared with the
	·CHANnel <v>·RMATh·RMS command</v>

:CHANnel<x>:RMATh:POWer:TERM:ESOurce

Function	Sets or queries the effective power calculation
	period's edge detection math source waveform of
	the specified channel.
Syntax	:CHANnel <x>:RMATh:POWer:</x>
	ESOurce {S1 S2 <nrf>[,<nrf>]}</nrf></nrf>
	:CHANnel <x>:RMATh:POWer:ESOurce?</x>
	<x> = 1 to 16</x>
Example	:CHANNEL1:RMATH:POWER:TERM:
	ESOURCE S1
	:CHANNEL1:RMATH:POWER:TERM:ESOURCE?
	-> :CHANNEL1:RMATH:POWER:TERM:
	ESOURCE S1
Description	• This command is valid on models with the /G3
	or /G5 option.
	 This setting is shared with the
	:CHANnel <x>:RMATh:RMS command.</x>
CHANne	1 <x1> RMATH · PWM · PERiod</x1>

Function	Sets or queries the period of the PWM operation.
Syntax	:CHANnel <x1>:RMATh:PWM:</x1>
	PERiod { <time>}</time>
	<x1> = 1 to 16</x1>
	<time> = 0.0000001 to 0.005 s (100 ns to 5 ms)</time>
Example	:CHANNEL1:RMATH:PWM:PERIOD 0.01
	:CHANNEL1:RMATH:PWM:PERIOD?
	-> :CHANNEL1:RMATH:PWM:PERIOD 0.01
Description	This command is valid on models with the /G3 or

/G5 option.

:CHANnel<x>:RMATh:RANGle?

Function Queries all settings related to the angle-ofrotation, electrical angle, sine, and cosine operations of the specified channel.

:CHANnel<x>:RMATh:RANGle? Syntax

- Description This command is valid on models with the /G3 or /G5 option.
 - · To set the math settings for the angleof-rotation, electrical angle, sine, and cosine operations, use the :CHANnel<x>:RMATh:RANGle command and the commands that are lower in its hierarchy. Before you set any of the settings, use the :CHANnel<x>:RMATh:OPERation command to set the operation type to RANGle, EANGle, SIN, or COS. For details on the commands that have different settings for the various operations, see the conditions that are written in the command descriptions.

: CHANne Function	Lx> : RMATh : RANGle : BLENgth Sets or queries the bit length when the encoding type is GRAY for the specified channel's angle- of-rotation, electrical angle, sine, and cosine
	operations.
Syntax	:CHANnel <x>:RMATh:RANGle:</x>
Cyntax	BLENgth { <nrf>}</nrf>
	:CHANnel <x>:RMATh:RANGle:BLENgth?</x>
	<pre><r><r><r><r><r><r><r><r></r></r></r></r></r></r></r></r></pre>
	<nrf>=2 to 16</nrf>
Example	
Lxample	CUNNELL, MAIN, RANGLE, DLENGIN 10
	-> · CHANNELI . MAIN . MANGLE . DLENGIN :
	BIENCTU 16
Description	This command is valid on models with the /G3 or
Description	
	/G5 option.
_	
:CHANne	el <x>:RMATh:RANGle:CCONdition</x>
Function	Sets or queries the resolution for the specified
	channel's angle-of-rotation, electrical angle, sine,
. .	and cosine operations.
Syntax	:CHANnel <x>:RMATh:RANGle:</x>
	CCONdition { <nri>}</nri>
	:CHANnel <x>:RMATh:RANGle:CCONdition?</x>
	<x> = 1 to 16</x>
	<nrt> = 1, 2, 4</nrt>
Example	:CHANNEL1:RMATH:RANGLE:CCONDITION 4
	:CHANNEL1:RMATH:RANGLE:CCONDITION?
	-> :CHANNEL1:RMATH:RANGLE:
	CCONDITION 4
Description	This command is valid on models with the /G3 or /G5 option.
: CHANne	<pre>el<x>:RMATh:RANGle:ETYPe (Edge</x></pre>
Type)	
Function	Sets or queries the encoding type for the
	specified channel's angle-of-rotation, electrical
	angle, sine, and cosine operations.
Syntax	:CHANnel <x>:RMATh:RANGle:</x>
-	ETYPe {ABZ AZ A8Bit A16Bit GRAY
	RESolver}
	:CHANnel <x>:RMATh:RANGle:ETYPe?</x>
	<x> = 1 to 16</x>
Example	:CHANNEL1:RMATH:RANGLE:ETYPE ABZ
	:CHANNEL1:RMATH:RANGLE:ETYPE?
	-> :CHANNEL1:RMATH:RANGLE:ETYPE AB7
Description	This command is valid on models with the /G3
Description	or /G5 option
	PESolver is valid when the operation type
	(CHANnelsys: PMATh: ODERation command)
	is set to EPANGO, SIN, or COS and when
	the operation type of enother real time meth
	chapped is set to REScher
	Channel IS Set to RESOIVER.

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:CHANne <x2></x2>	l <x1>:RMATh:RANGle:HYSTeresis</x1>	: CHAN
Function	Sets or queries the slope for the specified math source waveform for the specified channel's	
	angle-of-rotation, electrical angle, sine, and cosine operations.	Syntax
Syntax	:CHANnel <x>:RMATh:RANGle:HYSTeresis <x2> {HIGH LOW MIDDle}</x2></x>	
	:CHANnel <x>:RMATh:RANGle: HYSTeresis <x2>?</x2></x>	Example
	<x1> = 1 to 16</x1>	
	<x2> = 1 to 3</x2>	
Example	:CHANNEL1:RMATH:RANGLE: HYSTERESIS HIGH	Descripti
	:CHANNEL1:RMATH:RANGLE:HYSTERESIS? ->	
	:CHANNEL1:RMATH:RANGLE:	
Description	HISTERESIS HIGH	
Description	/G5 option.	: CHAN: <x2></x2>
		1 unction
Eunction	Sets or queries the detection level for the	
1 unction	specified math source waveform for the specified	
	channel's angle of rotation electrical angle sine	Syntax
	and cosine operations.	Oyntax
Syntax	:CHANnel <x>:RMATh:RANGle:</x>	
-)	LEVel <x2> {<voltage> <nrf> </nrf></voltage></x2>	
	<current>}</current>	
	:CHANnel <x>:RMATh:RANGle:LEVel<x2>?</x2></x>	
	<x1> = 1 to 16</x1>	
	<x2> = 1 to 3</x2>	
Example	:CHANNEL1:RMATH:RANGLE:LEVEL 1	
	:CHANNEL1:RMATH:RANGLE:LEVEL?	
	-> :CHANNEL1:RMATH:RANGLE: LEVEL 1.000000E+00	Example
Description	This command is valid on models with the /G3 or	
	/G5 option.	
	1 (Descripti
: CHANNE	Queries all the math source waveform acttings	
T UNCLOIT	for the specified channel's angle of rotation	
	electrical angle sine and cosine operations	
Syntax	·CHANnel <x>·RMATh·RANGle·LOGic?</x>	
Description	 This command is valid on models with the /G3 	
•	or /G5 option.	
	An execution error will occur if you specify a	
	channel other than that of a logic input module.	
		1

:CHANne	l <x>:RMATh:RANGle:LOGic:MODE</x>
Function	Sets or queries the math source waveform mode
	for the specified channel's angle-of-rotation,
	electrical angle, sine, and cosine operations.
Syntax	:CHANnel <x>:RMATh:RANGle:LOGic:</x>
	MODE { <boolean>}</boolean>
	:CHANnel <x>:RMATh:RANGle:LOGic:MODE?</x>
	<x> = 1 to 16</x>
Example	:CHANNEL1:RMATH:RANGLE:LOGIC:MODE 1
	:CHANNEL1:RMATH:RANGLE:LOGIC:MODE?
	-> :CHANNEL1:RMATH:RANGLE:LOGIC:
	MODE 1
Description	This command is valid on models with the /G3
	or /G5 option.
	 An execution error will occur if you specify a
	channel other than that of a logic input module.
·CHANne	1 <v1>·RMATH·RANCLA·LOGIC·SBIT</v1>
<x2> (S</x2>	ource BIT)
Function	Sets or queries the source bit when the math
1 dilotion	source waveform mode for the specified
	channel's angle-of-rotation electrical angle sine
	and cosine operations is logic
Syntax	:CHANnel <x1>:RMATh:RANGle:LOGic:SBIT</x1>
ojnak	<x2> {<nrf>}</nrf></x2>
	:CHANnel <x1>:RMATh:RANGle:LOGic:SBIT</x1>
	<x2>?</x2>
	<x1> = 1 to 16</x1>
	<x2> = 1 to 3</x2>
	1: Phase A setting
	2: Phase B setting
	3: Phase Z setting
	<nrf> = 1 to 8</nrf>
Example	:CHANNEL1:RMATH:RANGLE:LOGIC:SBIT1 1
	:CHANNEL1:RMATH:RANGLE:LOGIC:SBIT1?
	-> :CHANNEL1:RMATH:RANGLE:LOGIC:
	SBIT1 1
Description	• This command is valid on models with the /G3
	or /G5 option.
	An execution error will occur if you specify a

channel other than that of a logic input module.

: CHANne	el <x1>:RMATh:RANGle:LOGic:SOUR</x1>	: CHANne	el <x>:RMATh:RANGle:PROTate</x>
Function	Sets or queries the math source waveform when the math source waveform mode for the specified	Function	Sets or queries the number of pulses per rotation for the specified channel's angle-of-rotation,
	channel's angle-of-rotation, electrical angle, sine, and cosine operations is logic.	Syntax	:CHANnel <x>:RMATh:RANGle:</x>
Syntax	:CHANnel <x>:RMATh:RANGle:LOGic:SOURc e<x2> {<nrf>}</nrf></x2></x>		:CHANnel <x>:RMATh:RANGle:PROTate?</x>
	:CHANnel <x>:RMATh:RANGle:LOGic:SOURc</x>		<nrf> = 1 to 500000</nrf>
	<x1> = 1 to 16, <math><x2> = 1</x2></math> to 2</x1>		When the type is absolute 16 bit Maximum value 65536
Example	<pre><nrf> = 1 to 16 :CHANNEL1:RMATH:RANGLE:LOGIC:</nrf></pre>		When the type is absolute 8 bit
	SOURCE1 1	Example	CHANNEL1:RMATH:RANGLE:PROTATE 1
	SOURCE1?		:CHANNEL1:RMATH:RANGLE:PROTATE? -> :CHANNEL1:RMATH:RANGLE:PROTATE 1
	-> :CHANNEL1:RMATH:RANGLE:LOGIC: SOURCE1 1	Description	This command is valid on models with the /G3 or /G5 option.
Description	 This command is valid on models with the /G3 or /G5 option 	CHANDO	
	 An execution error will occur if you specify a channel other than that of a logic input module 	Function	Sets or queries whether the rotation direction is inverted for the specified channel's angle-
: CHANne	el <x1>:RMATh:RANGle:MRESet:EXE</x1>		of-rotation, electrical angle, sine, and cosine operations.
Cute Function	Resets the angle of the specified channel's angle	Syntax	:CHANnel <x>:RMATh:RANGle:</x>
	operations.		:CHANnel <x>:RMATh:RANGle:REVerse?</x>
Syntax	:CHANnel <x>:RMATh:RANGle:MRESet:EXEC ute</x>	Example	<pre><x> = 1 to 16 :CHANNEL1:RMATH:RANGLE:REVERSE 1</x></pre>
	<x1> = 1 to 16</x1>		:CHANNEL1:RMATH:RANGLE:REVERSE? ->
Description	/G5 option.	Description	: CHANNEL1 : RMATH : RANGLE : REVERSE 1 This command is valid on models with the /G3 or
: CHANne	el <x>:RMATh:RANGle:NLOGic</x>		/G5 option.
(Negati Function	ive Logic) Sets or queries the on/off status of negative logic	: CHANne	el <x1>:RMATh:RANGle:RSOurce</x1>
Syntax	in angle operations.	Function	Sets or queries the math source waveform when
Cyntax	NLOGic { <boolean>}</boolean>		the encoding type of the angle-of-rotation, sine,
	:CHANnel <x>:RMATh:RANGle:NLOGic? <x> = 1 to 16</x></x>	Syntax	:CHANnel <x1>:RMATh:RANGle:</x1>
Example	:CHANEL1:RMATH:RANGLE:NLOGIC 1		RSOurce {RMATh $<$ x2>}
	->:CHANEL1:RMATH:RANGLE:NLOGIC?		<x2> = 1 to 15</x2>
Description	This command is valid on models with the /G3 or	Example	:CHANNEL1:RMATH:RANGLE: BSOURCE RMATH1
			:CHANNEL1:RMATH:RANGLE:RSOURCE?
			-> :CHANNEL1:RMATH:RANGLE: RSOURCE RMATH1
		Description	This server and is valid on models with the 100 ser

Description This command is valid on models with the /G3 or /G5 option.

: CHANne	el <x>:RMATh:RANGle:RTIMing</x>
(Reset	Timing)
Function	Sets or queries the timing that will be used to
	reset the number of rotations for the specified
	channel's angle-of-rotation, electrical angle, sine,
	and cosine operations.
Syntax	:CHANnel <x>:RMATh:RANGle:</x>
	RTIMing {ZTERm ZARise ZA1L ZA2H
	ZA2L}
	:CHANnel <x>:RMATh:RANGle:RTIMing?</x>
	<x> = 1 to 16</x>
Example	:CHANNEL1:RMATH:RANGLE:RTIMING ZTERM
- 1 -	:CHANNEL1:RMATH:RANGLE:RTIMING?
	-> :CHANNEL1:RMATH:RANGLE:
	RTIMING ZTERM
Description	This command is valid on models with the /G3 or
Decomption	/G5 ontion
	1 4-1
: CHANNE	Sets or quories the seals of the specified
FUNCTION	sets of queries the scale of the specified
	channel's angle-of-rotation and electrical angle
• •	operations.
Syntax	:CHANnel <x>:RMATh:RANGle:</x>
	SCALe {DEGRee RADian USERdefine}
	:CHANnel <x>:RMATh:RANGle:SCALe?</x>
	<x1> = 1 to 16</x1>
Example	:CHANNEL1:RMATH:RANGLE:SCALE DEGREE
	:CHANNEL1:RMATH:RANGLE:SCALE?
	-> :CHANNEL1:RMATH:RANGLE:
	SCALE DEGREE
Description	This command is valid on models with the /G3 or /G5 option
	USERdefine can only be specified when the
	CHANnel <x>:RMATh:OPERation command</x>
	has been used to select RANGle
CUANDO	1
(Course	INX/:RMAIN:RANGLE:SLOGIC
Eunction	Sets or quories the math source waveform type
T UNCLOIT	for the aposition channel's angle of rotation
Curtary	
Syntax	:CHANNEL <x>:RMATH:RANGLE:</x>
	SLOGIC { <boolean>}</boolean>
	:CHANNEL <x>:KMATN:RANGle:SLOGic?</x>
	<x> = 1 to 16</x>
Example	:CHANNEL1:RMATH:RANGLE:SLOGIC 1
	:CHANNEL1:RMATH:RANGLE:SLOGIC?
	-> :CHANNEL1:RMATH:RANGLE:SLOGIC 1
Description	This command is valid on models with the /G3 or
	/G5 option.
	/G5 option.

the math source waveform mode for the specified channel's angle-of-rotation, electrical angle, sine, and cosine operations is not logic. Syntax :CHANnel<x1>:RMATh:RANGle: SOURce<x2> {<NRf>[,<NRf>]} :CHANnel<x1>:RMATh:RANGle:SOURce <x2>? <x1> = 1 to 16 <x2> = 1 to 3 <NRf> = 1 to 16 Example :CHANNEL1:RMATH:RANGLE:SOURCE1 1 :CHANNEL1:RMATH:RANGLE:SOURCE1? -> :CHANNEL1:RMATH:RANGLE:SOURCE1 1 Description This command is valid on models with the /G3 or /G5 option. :CHANnel<x1>:RMATh:RANGle:TIMing<x2> (Edge Timing) Sets or queries the edge detection timing for the Function specified channel's angle-of-rotation, electrical angle, sine, and cosine operations. :CHANnel<x>:RMATh:RANGle: Syntax TIMing {ARISe|S1Low|S2High|S2Low} :CHANnel<x>:RMATh:RANGle:TIMing? <x1> = 1 to 16 <x2> = 1, 2 Example :CHANNEL1:RMATH:RANGLE:TIMING ARISE :CHANNEL1:RMATH:RANGLE:TIMING? -> :CHANNEL1:RMATH:RANGLE: TIMING ARISE Description This command is valid on models with the /G3 or /G5 option. :CHANnel<x>:RMATh:RANGle:ZINVert Function Sets or queries whether the Z phase is inverted for the specified channel's angle-of-rotation, electrical angle, sine, and cosine operations. :CHANnel<x>:RMATh:RANGle: Syntax ZINVert {<Boolean>} :CHANnel<x>:RMATh:RANGle:ZINVert? :CHANNEL3:RMATH:RANGLE:ZINVERT ON Example :CHANNEL3:RMATH:RANGLE:ZINVERT? → :CHANNEL3:RMATH:RANGLE:ZINVERT ON Description This command is valid on models with the /G3 or /G5 option.

:CHANnel<x1>:RMATh:RANGle:SOURce<x2>

Sets or queries the math source waveform when

Function

:CHANnel<x1>:RMATh:RESolver?

Function	Queries all resolver operation settings.
Syntax	:CHANnel <x1>:RMATh:RESolver?</x1>
	<x1> = 1 to 16</x1>
D · //	T I: II I

Description This command is valid on models with the /G3 or /G5 option.

: CHANne	l <x1>:RMATh:RESolver:PHASe</x1>
Function	Sets or queries the angle combination of 3 phase
	resolver operation.
Syntax	:CHANnel <x1>:RMATh:RESolver:</x1>
	PHASe {P1 P2 P3}
	<x1> = 1 to 16</x1>
	P1: 0°-120°, P2: 0°-240°, P3: 120°-240°
Example	CHANNEL2:RMATH:RESOLVER:PHASE PI
	CHANNELZ: KMATH: RESOLVER: PHASE?
Description	This command is valid on models with the /G3
Description	option.
: CHANNE	Sats or quories the offset angle of resolver
	operation
Syntax	:CHANnel <x1>:RMATh:RESolver:OFFSet</x1>
Oyntax	<pre>{<nrf>}</nrf></pre>
	<x1> = 1 to 15</x1>
	<nrf> = -180 to180</nrf>
	Angle setting in unit of 0.01°
Example	:CHANNEL2:RMATH:RESOLVER:OFFSET 60
	:CHANNEL2:RMATH:RESOLVER:OFFSET?
	-> :CHANNEL2:RMATH:RESOLVER:
	OFFSET 60
Description	This command is valid on models with the /G3
	option.
: CHANne	l <x1>:RMATh:RESolver:SOURce</x1>
<x2></x2>	
Function	Sets or queries the math source waveform of the
	resolver operation.
Syntax	:CHANnel <x1>:RMATh:RESolver:</x1>
	SOURce <x2> {<nrf>[,<nrf>]}</nrf></nrf></x2>
	<x1> = 1 to 16</x1>
	<x2> = 1 to 3</x2>
	Resolver operation
	1: Carrier channel (excitation waveform)
	2: sin0 channel
	3: cost channel
	3-phase resolver operation (0°-120°)
	2: sin0° channel
	2. sin120° channel
	3-phase resolver operation (0°-240 °)
	1: Carrier channel (excitation waveform)
	2: sin0° channel
	3: sin240° channel
	3-phase resolver operation (120 °-240 °)
	1: Carrier channel (excitation waveform)
	2: sin120° channel
	3: sin240° channel
Example	:CHANNEL1:RMATH:RESOLVER:SOURCE1 1
	:CHANNEL1:RMATH:RESOLVER:SOURCE1?
	-> :CHANNEL1:RMATH:RESOLVER:
Decoriction	SOURCE1 1 This command is valid as models with the VCC
Description	option.
	- P

nie Mode	a)
Function	Sets or queries the sample mode of the resolve
Curreterie	operation.
Syntax	:CHANNEL <xi>:RMATH:RESolver:</xi>
	SMODE {AUTO MANUAL }
Eveneele	
Example	:CHANNEL1:RMATH:RESOLVER:SMODE AUTO :CHANNEL1:RMATH:RESOLVER:SMODE?
	-> :CHANNEL1:RMATH:RESOLVER:
Description	This command is valid on models with the /G3 o /G5 option.
:CHANne	el <x1>:RMATh:RESolver:HYSTeresis</x1>
Function	Sets or queries the hysteresis of the resolver
	operation when the sample mode is set to AUT
Syntax	:CHANnel <x1>:RMATh:RESolver:</x1>
	HYSTeresis {HIGH LOW MIDDle}
	<x1> = 1 to 16</x1>
Example	:CHANNEL1:RMATH:RESOLVER:
	• CHANNELL• RMATH• RESOLVER• HYSTERES IS
	:CHANNELI:RMATH:RESOLVER:HYSTERESIS
	<pre>:CHANNEL1:RMATH:RESOLVER:HYSTERESIS -> :CHANNEL1:RMATH:RESOLVER: HYSTERESIS LOW</pre>
Description	-> :CHANNEL1:RMATH:RESOLVER:HYSTERESIS HYSTERESIS LOW
Description	<pre>:CHANNEL1:RMATH:RESOLVER:HYSTERESIS -> :CHANNEL1:RMATH:RESOLVER: HYSTERESIS LOW This command is valid on models with the /G3 of /G5 option. !<x1>:RMATh:RESolver:STIMe (Same)</x1></pre>
Description :CHANne mpling Function	<pre>:CHANNEL1:RMATH:RESOLVER:HYSTERESIS -> :CHANNEL1:RMATH:RESOLVER: HYSTERESIS LOW This command is valid on models with the /G3 of /G5 option. !<x1>:RMATh:RESolver:STIMe (Solver) Sets or queries the time from the excitation waveform edge of the resolver operation when</x1></pre>
Description :CHANne mpling Function	<pre>:CHANNEL1:RMATH:RESOLVER:HYSTERESIS -> :CHANNEL1:RMATH:RESOLVER: HYSTERESIS LOW This command is valid on models with the /G3 of /G5 option. !<x1>:RMATh:RESolver:STIMe (Sa Time) Sets or queries the time from the excitation waveform edge of the resolver operation when the sample mode is set to MANual.</x1></pre>
Description :CHANne mpling Function Syntax	<pre>:CHANNEL1:RMATH:RESOLVER:HYSTERESIS -> :CHANNEL1:RMATH:RESOLVER: HYSTERESIS LOW This command is valid on models with the /G3 of /G5 option. !<x1>:RMATh:RESolver:STIMe (Sa Time) Sets or queries the time from the excitation waveform edge of the resolver operation when the sample mode is set to MANual. :CHANnel<x1>:RMATh:RESolver:</x1></x1></pre>
Description :CHANne mpling Function Syntax	<pre>:CHANNEL1:RMATH:RESOLVER:HYSTERESIS -> :CHANNEL1:RMATH:RESOLVER: HYSTERESIS LOW This command is valid on models with the /G3 of /G5 option. !<x1>:RMATh:RESolver:STIMe (Sa Time) Sets or queries the time from the excitation waveform edge of the resolver operation when the sample mode is set to MANual. :CHANnel<x1>:RMATh:RESolver: STIMe {<time>}</time></x1></x1></pre>
Description :CHANne mpling Function Syntax	<pre>:CHANNEL1:RMATH:RESOLVER:HYSTERESIS -> :CHANNEL1:RMATH:RESOLVER: HYSTERESIS LOW This command is valid on models with the /G3 of /G5 option. :l<x1>:RMATh:RESolver:STIMe (Sa Time) Sets or queries the time from the excitation waveform edge of the resolver operation when the sample mode is set to MANual. :CHANnel<x1>:RMATh:RESolver: STIMe {<time>} <x1> = 1 to 16</x1></time></x1></x1></pre>
Description : CHANne mpling Function Syntax Example	<pre>:CHANNEL1:RMATH:RESOLVER:HYSTERESIS -> :CHANNEL1:RMATH:RESOLVER: HYSTERESIS LOW This command is valid on models with the /G3 of /G5 option. :l<x1>:RMATh:RESolver:STIMe (So Time) Sets or queries the time from the excitation waveform edge of the resolver operation when the sample mode is set to MANual. :CHANnel<x1>:RMATh:RESolver: STIMe {<time>} <x1> = 1 to 16 <time> = 0.0000001 to 0.001 s (100 ns to 1 ms :CHANNEL1:RMATH:RESOLVER:</time></x1></time></x1></x1></pre>
Description : CHANne mpling Function Syntax Example	<pre>:CHANNEL1:RMATH:RESOLVER:HYSTERESIS -> :CHANNEL1:RMATH:RESOLVER: HYSTERESIS LOW This command is valid on models with the /G3 of /G5 option. :L<x1>:RMATh:RESolver:STIMe (S. Time) Sets or queries the time from the excitation waveform edge of the resolver operation when the sample mode is set to MANual. :CHANnel<x1>:RMATh:RESolver: STIMe {<time>} <x1> = 1 to 16 <time> = 0.0000001 to 0.001 s (100 ns to 1 ms :CHANNEL1:RMATH:RESOLVER: STIME 0.0001</time></x1></time></x1></x1></pre>
Description : CHANne mpling Function Syntax Example	<pre>:CHANNEL1:RMATH:RESOLVER:HYSTERESIS -> :CHANNEL1:RMATH:RESOLVER: HYSTERESIS LOW This command is valid on models with the /G3 of /G5 option. (G5 option. (At a second secon</pre>
Description :CHANne mpling Function Syntax Example	<pre>:CHANNEL1:RMATH:RESOLVER:HYSTERESIS -> :CHANNEL1:RMATH:RESOLVER: HYSTERESIS LOW This command is valid on models with the /G3 of /G5 option. L(x1>:RMATh:RESolver:STIMe (Sa Time) Sets or queries the time from the excitation waveform edge of the resolver operation when the sample mode is set to MANual. :CHANNel<x1>:RMATh:RESolver: STIMe {<time>} <x1> = 1 to 16 <time> = 0.0000001 to 0.001 s (100 ns to 1 ms :CHANNEL1:RMATH:RESOLVER: STIME 0.0001 :CHANNEL1:RMATH:RESOLVER:STIME? -> :CHANNEL1:RMATH:RESOLVER:</time></x1></time></x1></pre>
Description : CHANne mpling Function Syntax Example	<pre>:CHANNEL1:RMATH:RESOLVER:HYSTERESIS -> :CHANNEL1:RMATH:RESOLVER: HYSTERESIS LOW This command is valid on models with the /G3 of /G5 option. (G5 option. (C5 option. (C5 option.) (C5 option.) (C5 option.) (C5 option.) (C6 option.) (C7 option.)</pre>
Description :CHANne mpling Function Syntax Example Description	<pre>:CHANNEL1:RMATH:RESOLVER:HYSTERESIS -> :CHANNEL1:RMATH:RESOLVER: HYSTERESIS LOW This command is valid on models with the /G3 of /G5 option. :L<x1>:RMATh:RESolver:STIMe (Sa Time) Sets or queries the time from the excitation waveform edge of the resolver operation when the sample mode is set to MANual. :CHANNel<x1>:RMATh:RESolver: STIMe {<time>} <x1> = 1 to 16 <time> = 0.0000001 to 0.001 s (100 ns to 1 ms :CHANNEL1:RMATH:RESOLVER: STIME 0.0001 :CHANNEL1:RMATH:RESOLVER:STIME? -> :CHANNEL1:RMATH:RESOLVER: STIME 1.0E-3 This command is valid on models with the /G3 of /S5 artist</time></x1></time></x1></x1></pre>

: CHANne Function	Sets or queries the tracking filter of the resolver
	operation.
Syntax	:CHANnel <x1>:RMATh:RESolver: TFILter {OFF <nrf>}</nrf></x1>
	<x1> = 1 to 16</x1>
	<nrf> = 100, 250, 1000, 2000</nrf>
Example	CHANNEL1: RMATH: RESOLVER: TETLTER 100
Example	·CHANNEL1 · RMATH·RESOLVER·TFILTER?
	-> ·CHANNEI 1 · DMATH · DEGOIVED ·
	-/ .CHANNELI.AMAIH.AESOLVEA.
Decerintien	This command is valid on models with the (O2 on
Description	/G5 option.
:CHANne	l <x1>:RMATh:RESolver:SCALe</x1>
Function	Sets or queries the scale of the resolver
	operation.
Syntax	:CHANnel <x1>:RMATh:RESolver:</x1>
	SCALe {DEG1 DEG2 RAD1 RAD2 }
	<x1> = 1 to 16</x1>
	DEG1: Degrees (-180 to +180)
	DEG2: Degrees (0 to +360)
	RAD1: Radians (–π to π)
	RAD2: Radians (0 to 2π)
Example	:CHANNEL1:RMATH:RESOLVER:SCALE DEG1
·	:CHANNEL1:RMATH:RESOLVER:SCALE?
	-> :CHANNEL1:RMATH:RESOLVER:
	SCALE DEG1
Description	This command is valid on models with the /G3 or /G5 option.
: CHANne	l <x>:RMATh:RMS?</x>
Function	Queries all RMS calculation period settings of the
	specified channel
Syntax	:CHANnel <x>:RMATh:RMS?</x>
Description	This command is valid on models with the /G3 or
Description	/G5 option.
Eurotion	Sote or quories the adde detection methods are
Function	Sets or queries the edge detection math source
	waveform (the detection bit) for when the RMS
	ta addae (when a legis channel is being used as
	to edge (when a logic channel is being used as
Curtav	
Syntax	:CHANNEl <x>:RMATN:RMS:TERM:</x>
	LBIT (<nkl>)</nkl>
	:CHANNELSX?:RMATH:RMS:TERM:EBIT?
	x = 1 to 0
F	
Example	:CHANNEL1:RMATH:RMS:TERM:EBIT 1
	:CHANNEL1:RMATH:RMS:TERM:EBIT?
D	-> :CHANNEL1:RMATH:RMS:TERM:EBIT 1
Description	I his command is valid on models with the /G3
	or /G5 option.
	This setting is shared with the
	:CHANnel <x>:RMATh:POWer command.</x>

: CHANne	l <x>:RMATh:RMS:TERM:EHYSteres</x>
is	
Function	Sets or queries the detection hysteresis for when
	the RMS calculation period of the specified
	channel is set to edge.
Syntax	:CHANnel <x>:RMATh:RMS:TERM:EHYSteres</x>
- ,	is {HIGH LOW MIDDle}
	:CHANnel <x>:RMATh:RMS:TERM:EHYSteres</x>
	is?
	x = 1 to 16
Evomplo	- CHANNEL 1 - DMARH - DMC - REDM.
Example	EUVOMEDECIO, HICH
	CULNINEL 1 DALEY DAG FEDA
	:CHANNELI:RMATH:RMS:TERM:
	EHYSTERESIS?
	-> :CHANNELI:RMATH:RMS:TERM:
	EHYSTERESIS HIGH
Description	This command is valid on models with the /G3
	or /G5 option.
	 This setting is shared with the
	:CHANnel <x>:RMATh:POWer command.</x>
:CHANne	l <x>:RMATh:RMS:TERM:ELEVel</x>
Function	Sets or queries the detection level for when the
	RMS calculation period of the specified channel
	is set to edge.
Syntax	:CHANnel <x>:RMATh:RMS:TERM:</x>
-)	ELEVel { <voltage> <nrf> <current>}</current></nrf></voltage>
	·CHANnel <x>·RMATh·RMS·TERM·ELEVel?</x>
	xx = 1 to 16
Eveneele	
Example	:CHANNEL:RMATH:RMS:TERM:ELEVEL 1
	:CHANNELI:RMATH:RMS:TERM:ELEVEL?
	-> :CHANNEL1:RMATH:RMS:TERM:
	ELEVEL 1.000000E+00
Description	This command is valid on models with the /G3
	or /G5 option.
	 This setting is shared with the
	:CHANnel <x>:RMATh:POWer command.</x>
:CHANne	1 <x>: RMATh: RMS: TERM: ESLODE</x>
Function	Sets or queries the detection slope for when the
	RMS calculation period of the specified channel
	is set to edge
Suptor	CUANTO LATA DMATCH DMC TEDM.
Syntax	:CHANNEL <x>: RMATH: RMS:TERM:</x>
	ESLOpe {BISLOpe FALL RISE}
	:CHANnel <x>:RMATh:RMS:TERM:ESLope?</x>
	<x> = 1 to 16</x>
Example	:CHANNEL1:RMATH:RMS:TERM:ESLOPE FALL
	:CHANNEL1:RMATH:RMS:TERM:ESLOPE?
	-> :CHANNEL1:RMATH:RMS:TERM:
	ESLOPE FALL
Description	• This command is valid on models with the /G3
	or /G5 option.
	This setting is shared with the
	CHANnel <x>·RMATh·POWer command</x>

: CHANne	1 <x>:RMATh:RMS:TERM:ESOurce</x>		
Function	Sets or gueries the edge detection math source		
	waveform for when the RMS calculation period of		
	the specified channel is set to edge.		
Syntax	:CHANnel <x>:RMATh:RMS:TERM:</x>		
e j max	ESOurce (OWN/ <nrf>[.<nrf>]</nrf></nrf>		
	·CHANnel <v>·DMATh·DMS·TEDM·ESOurce?</v>		
	1 to 16		
	<x2> = 1 (0 15</x2>		
Example	:CHANNELI:RMATH:RMS:TERM:ESOURCE OWN		
	:CHANNEL1:RMATH:RMS:TERM:ESOURCE?		
	-> :CHANNEL1:RMATH:RMS:TERM:		
	ESOURCE OWN		
Description	This command is valid on models with the /G3		
	or /G5 option.		
	This setting is shared with the		
	:CHANnel <x>:RMATh:POWer command.</x>		
: CHANNE	Sets or quories the RMS : TERM : MODE		
FUNCTION	Sets of queries the RMS calculation period mode		
0			
Syntax	:CHANnel <x>:RMATh:RMS:TERM:</x>		
	MODE {TIME EDGE }		
	:CHANnel <x>:RMATh:RMS:TERM:MODE?</x>		
	<x> = 1 to 16</x>		
Example	:CHANNEL1:RMATH:RMS:TERM:MODE TIME		
	:CHANNEL1:RMATH:RMS:TERM:MODE?		
	-> :CHANNEL1:RMATH:RMS:TERM:		
	MODE TIME		
Description	This command is valid on models with the /G3 or		
/G5 option.			
: CHANne	Coto on superior the interval for when the DMC		
Function	Sets or queries the interval for when the RMS		
	calculation period of the specified channel is set		
	to time.		
Syntax	:CHANnel <x>:RMATh:RMS:TERM:</x>		
	TIME { <time>}</time>		
	:CHANnel <x>:RMATh:RMS:TERM:TIME?</x>		
	<x> = 1 to 16</x>		
	<time> = 1ms to 500.0ms</time>		
Example	:CHANNEL1:RMATH:RMS:TERM:TIME 100ms		
	:CHANNEL1:RMATH:RMS:TERM:TIME?		
	-> :CHANNEL1:RMATH:RMS:TERM:		
	TIME 100ms		
Description	This command is valid on models with the /G3 or		
Besserption	/G5 ontion		

Function			
	Sets or queries the apparent-power, effective-		
	power, voltage, or current channel used to		
	calculate the reactive power of the specified		
	channel.		
Syntax	:CHANnel <x>:RMATh:RPOWer:</x>		
	SOURce <x2> {<nrf>[,<nrf>] RMATh<x3>}</x3></nrf></nrf></x2>		
	:CHANnel <x>:RMATh:RPOWer:SOURce<x2>?</x2></x>		
	<x> = 1 to 16</x>		
	<x2> = 1 to 4</x2>		
	1: ApparentPower		
	2: EffectivePower		
	3: Voltage		
	4: Current		
	<x3> = 1 to 15</x3>		
Example	:CHANNEL:RMATH:RPOWER:SOURCE RMATH1		
	:CHANNEL:RMATH:RPOWER:SOURCE?		
	-> :CHANNEL:RMATH:RPOWER:		
	SOURCE RMATH1		
Description	• This command is valid on models with the /G3		
	or /G5 option.		
	You can also use the		
	CHANnel <x>:RMATh:SC<x> command.</x></x>		
:CHANne Teresis	CHANnel <x>:RMATh:SC<x> command. 1<x>:RMATh:RPOWer:VOLTage:HYS</x></x></x>		
:CHANne Teresis Function	CHANnel <x>:RMATh:SC<x> command. 1<x>:RMATh:RPOWer:VOLTage:HYS Sets or queries the hysteresis of the voltage</x></x></x>		
:CHANne Teresis Function	CHANnel <x>:RMATh:SC<x> command. 1<x>:RMATh:RPOWer:VOLTage:HYS</x> Sets or queries the hysteresis of the voltage channel used to calculate the reactive power of</x></x>		
:CHANne Teresis Function	CHANnel <x>:RMATh:SC<x> command. 1<x>:RMATh:RPOWer:VOLTage:HYS</x> Sets or queries the hysteresis of the voltage channel used to calculate the reactive power of the specified channel.</x></x>		
: CHANne Teresis Function Syntax	CHANnel <x>:RMATh:SC<x> command. I<x>:RMATh:RPOWer:VOLTage:HYS</x> Sets or queries the hysteresis of the voltage channel used to calculate the reactive power of the specified channel. :CHANnel<x>:RMATh:RPOWer:VOLTage:</x></x></x>		
: CHANne Teresis Function Syntax	CHANnel <x>:RMATh:SC<x> command. I<x>:RMATh:RPOWer:VOLTage:HYS</x> Sets or queries the hysteresis of the voltage channel used to calculate the reactive power of the specified channel. :CHANnel<x>:RMATh:RPOWer:VOLTage: HYSTeresis {HIGH LOW MIDDle}</x></x></x>		
:CHANne Teresis Function Syntax	CHANnel <x>:RMATh:SC<x> command. I<x>:RMATh:RPOWer:VOLTage:HYS</x> Sets or queries the hysteresis of the voltage channel used to calculate the reactive power of the specified channel. :CHANnel<x>:RMATh:RPOWer:VOLTage: HYSTeresis {HIGH LOW MIDDle} :CHANnel<x>:RMATh:RPOWer:VOLTage:</x></x></x></x>		
:CHANne Teresis Function Syntax	CHANnel <x>:RMATh:SC<x> command. I<x>:RMATh:RPOWer:VOLTage:HYS</x> Sets or queries the hysteresis of the voltage channel used to calculate the reactive power of the specified channel. :CHANnel<x>:RMATh:RPOWer:VOLTage: HYSTeresis {HIGH LOW MIDDle} :CHANnel<x>:RMATh:RPOWer:VOLTage: HYSTeresis?</x></x></x></x>		
: CHANne Teresis Function Syntax	CHANnel <x>:RMATh:SC<x> command. I<x>:RMATh:RPOWer:VOLTage:HYS</x> Sets or queries the hysteresis of the voltage channel used to calculate the reactive power of the specified channel. :CHANnel<x>:RMATh:RPOWer:VOLTage: HYSTeresis {HIGH LOW MIDDle} :CHANnel<x>:RMATh:RPOWer:VOLTage: HYSTeresis? <x> = 1 to 16</x></x></x></x></x>		
: CHANne Teresis Function Syntax Example	CHANnel <x>:RMATh:SC<x> command. I<x>:RMATh:RPOWer:VOLTage:HYS</x> Sets or queries the hysteresis of the voltage channel used to calculate the reactive power of the specified channel. :CHANnel<x>:RMATh:RPOWer:VOLTage: HYSTeresis {HIGH LOW MIDDle} :CHANnel<x>:RMATh:RPOWer:VOLTage: HYSTeresis? <x> = 1 to 16 :CHANNEL:RMATH:RPOWER:VOLTAGE:</x></x></x></x></x>		
: CHANne Teresis Function Syntax Example	CHANnel <x>:RMATh:SC<x> command. I<x>:RMATh:RPOWer:VOLTage:HYS</x> Sets or queries the hysteresis of the voltage channel used to calculate the reactive power of the specified channel. :CHANnel<x>:RMATh:RPOWer:VOLTage: HYSTeresis {HIGH LOW MIDDle} :CHANnel<x>:RMATh:RPOWer:VOLTage: HYSTeresis? <x> = 1 to 16 :CHANNEL:RMATH:RPOWER:VOLTAGE: HYSTERESIS HIGH</x></x></x></x></x>		
: CHANne Teresis Function Syntax Example	CHANnel <x>:RMATh:SC<x> command. I<x>:RMATh:RPOWer:VOLTage:HYS</x> Sets or queries the hysteresis of the voltage channel used to calculate the reactive power of the specified channel. :CHANnel<x>:RMATh:RPOWer:VOLTage: HYSTeresis {HIGH LOW MIDDle} :CHANnel<x>:RMATh:RPOWer:VOLTage: HYSTeresis? <x> = 1 to 16 :CHANNEL:RMATH:RPOWER:VOLTAGE: HYSTERESIS HIGH :CHANNEL:RMATH:RPOWER:VOLTAGE:</x></x></x></x></x>		
: CHANne Teresis Function Syntax Example	CHANnel <x>:RMATh:SC<x> command. I<x>:RMATh:RPOWer:VOLTage:HYS Sets or queries the hysteresis of the voltage channel used to calculate the reactive power of the specified channel. :CHANnel<x>:RMATh:RPOWer:VOLTage: HYSTeresis {HIGH LOW MIDDle} :CHANnel<x>:RMATh:RPOWer:VOLTage: HYSTeresis? <x> = 1 to 16 :CHANNEL:RMATH:RPOWER:VOLTAGE: HYSTERESIS HIGH :CHANNEL:RMATH:RPOWER:VOLTAGE: HYSTERESIS?</x></x></x></x></x></x>		
: CHANne Teresis Function Syntax Example	CHANnel <x>:RMATh:SC<x> command. I<x>:RMATh:RPOWer:VOLTage:HYS Sets or queries the hysteresis of the voltage channel used to calculate the reactive power of the specified channel. :CHANnel<x>:RMATh:RPOWer:VOLTage: HYSTeresis {HIGH LOW MIDDle} :CHANnel<x>:RMATh:RPOWer:VOLTage: HYSTeresis? <x> = 1 to 16 :CHANNEL:RMATH:RPOWER:VOLTAGE: HYSTERESIS HIGH :CHANNEL:RMATH:RPOWER:VOLTAGE: HYSTERESIS? -> :CHANNEL:RMATH:RPOWER:VOLTAGE:</x></x></x></x></x></x>		
: CHANne Teresis Function Syntax Example	CHANnel <x>:RMATh:SC<x> command. I<x>:RMATh:RPOWer:VOLTage:HYS Sets or queries the hysteresis of the voltage channel used to calculate the reactive power of the specified channel. :CHANnel<x>:RMATh:RPOWer:VOLTage: HYSTeresis {HIGH LOW MIDDle} :CHANnel<x>:RMATh:RPOWer:VOLTage: HYSTeresis? <x> = 1 to 16 :CHANNEL:RMATH:RPOWER:VOLTAGE: HYSTERESIS HIGH :CHANNEL:RMATH:RPOWER:VOLTAGE: HYSTERESIS? -> :CHANNEL:RMATH:RPOWER:VOLTAGE: HYSTERESIS HIGH</x></x></x></x></x></x>		

·CHANne	$1 < v 1 > \cdot RMDTh \cdot SC < v > >$
Function	Sets or queries source waveforms 1 to 3 of the
1 dilotion	currently specified real time math operation
Svntax	:CHANnel <x1>:RMATh:</x1>
ojinan	SC <x2> {<nrf>[,<nrf>] RMATh<x3>}</x3></nrf></nrf></x2>
	:CHANnel <x1>:RMATh:SC<x2>?</x2></x1>
	<x2> = 1 to 3</x2>
	$< x_3 > = 1 \text{ to } 15$
	$\langle NRf \rangle = 1$ to 16
Example	
Livample	CHANNELI.RMATH.SCI 1
	-> CHANNEL1.RMATH.SC1 1
Description	This command is valid on models with the /G3
Description	or /G5 option
	of 765 option.
	CHANNELS I >.RMATH.FREQ.SOURCE
	odgo count operations
	To set the target of the electrical angle
	operation use this command with parameter
	<pre>cyperation, use this command with parameter </pre>
	SAF 30110 0.
:CHANne	1 < x > : RMATh : SC4
Function	Sets or queries source waveform 4 for the
	polynomial with a coefficient operation of the
	specified real time math channel.
Svntax	:CHANnel <x>:RMATh:</x>
-)	SC4 {Off <nrf>[,<nrf>] RMATh<x3>}</x3></nrf></nrf>
	:CHANnel <x>:RMATh:SC4?</x>
	<x3> = 1 to 15</x3>
	<nrf> = 1 to 16</nrf>
Example	CHANNEL1: RMATH: SC4 1
Example	CHANNEL1: RMATH: SC4?
	-> CHANNEL1:RMATH:SC4 1
Description	This command is valid on models with the /G3 or
	/G5 option.
:CHANne	l <x>:RMATh:SCALe</x>
Function	Sets or gueries the two ends of the scale of the
	specified RMath channel (the specified channel
	when real time math is turned on)
Syntax	·CHANnel <x>·RMATh·SCALe {<nrf>.</nrf></x>
Oyntax	<pre></pre>
	·CUANDOJ / WN · DMATTH · SCALO?
	:CHANNEL X2:RMAIN:SCALE?
	$\langle x \rangle = 1$ to 16
- ·	<inki> = -9.99999E+30 to +9.9999E+30</inki>
Example	:CHANNEL1:RMATH:
	SCALE -1.0000E+10,+1.0000E+10
	:CHANNEL1:RMATH:SCALE?
	-> :CHANNEL1:RMATH:
	SCALE {-1.0000E+10,+1.0000E+10}
Description	This command is valid on models with the /G3 or
	/G5 option.

Function	Sets or queries the sign for the specified
	channel's square root operation.
Syntax	:CHANnel <x>:RMATh:SQRT1:</x>
	SIGN {MINus PLUS}
	:CHANnel <x>:RMATh:SQRT1:SIGN?</x>
	<x1> = 1 to 16</x1>
Example	:CHANNEL1:RMATH:SQRT1:SIGN1 PLUS
	:CHANNEL1:RMATH:SQRT1:SIGN1?
	-> :CHANNEL1:RMATH:SQRT1:SIGN1 PLUS
Description	This command is valid on models with the /G3
	/G5 option.
: CHANne	l <x>:RMATh:UNIT</x>
Function	Sets or queries the unit string of the specified
	RMath channel (the specified channel when re-
	time math is turned on).
Syntax	:CHANnel <x>:RMATh:UNIT {<string>}</string></x>
	:CHANnel <x>:RMATh:UNIT?</x>
	<x> = 1 to 16</x>
	<string> = Up to 4 characters</string>
Example	:CHANNEL1:RMATH:UNIT "RPM"
	:CHANNEL1:RMATH:UNIT?
	-> :CHANNEL1:RMATH:UNIT "RPM"
Description	This command is valid on models with the /G3
	/G5 option.
: CHANne	l <x>:RMATh:VARiable</x>
Function	Sets or queries the vertical scale setup method
	of the specified RMath channel (the specified
	ale and a locale and a set there are after to the set and the set
	channel when real time math is turned on).
Syntax	:CHANnel
Syntax	<pre>channel when real time math is turned on). :CHANnel<x>:RMATh: VARiable {<boolean>}</boolean></x></pre>
Syntax	<pre>channel when real time math is turned on). :CHANnel<x>:RMATh: VARiable {<boolean>} :CHANnel<x>:RMATh:VARiable?</x></boolean></x></pre>
Syntax	<pre>channel when real time math is turned on). :CHANnel<x>:RMATh: VARiable {<boolean>} :CHANnel<x>:RMATh:VARiable? <x> = 1 to 16</x></x></boolean></x></pre>
Syntax Example	<pre>channel when real time math is turned on). :CHANnel<x>:RMATh: VARiable {<boolean>} :CHANnel<x>:RMATh:VARiable? <x> = 1 to 16 :CHANNEL1:RMATH:VARIABLE 1</x></x></boolean></x></pre>
Syntax Example	<pre>channel when real time math is turned on). :CHANnel<x>:RMATh: VARiable {<boolean>} :CHANnel<x>:RMATh:VARiable? <x> = 1 to 16 :CHANNEL1:RMATH:VARIABLE 1 :CHANNEL1:RMATH:VARIABLE?</x></x></boolean></x></pre>
Syntax Example	<pre>channel when real time math is turned on). :CHANnel<x>:RMATh: VARiable {<boolean>} :CHANnel<x>:RMATh:VARiable? <x> = 1 to 16 :CHANNEL1:RMATH:VARIABLE 1 :CHANNEL1:RMATH:VARIABLE? -> :CHANNEL1:RMATH:VARIABLE 1</x></x></boolean></x></pre>
Syntax Example Description	<pre>channel when real time math is turned on). :CHANnel<x>:RMATh: VARiable {<boolean>} :CHANnel<x>:RMATh:VARiable? <x> = 1 to 16 :CHANNEL1:RMATH:VARIABLE 1 :CHANNEL1:RMATH:VARIABLE? -> :CHANNEL1:RMATH:VARIABLE 1 This command is valid on models with the /G3</x></x></boolean></x></pre>
Syntax Example Description	<pre>channel when real time math is turned on). :CHANnel<x>:RMATh: VARiable {<boolean>} :CHANnel<x>:RMATh:VARiable? <x> = 1 to 16 :CHANNEL1:RMATH:VARIABLE 1 :CHANNEL1:RMATH:VARIABLE? -> :CHANNEL1:RMATH:VARIABLE 1 This command is valid on models with the /G3 /G5 option.</x></x></boolean></x></pre>
Syntax Example Description :CHANne	<pre>channel when real time math is turned on). :CHANnel<x>:RMATh: VARiable {<boolean>} :CHANnel<x>:RMATh:VARiable? <x> = 1 to 16 :CHANNEL1:RMATH:VARIABLE 1 :CHANNEL1:RMATH:VARIABLE? -> :CHANNEL1:RMATH:VARIABLE 1 This command is valid on models with the /G3 /G5 option. </x></x></boolean></x></pre>
Syntax Example Description :CHANne Function	<pre>channel when real time math is turned on). :CHANnel<x>:RMATh: VARiable {<boolean>} :CHANnel<x>:RMATh:VARiable? <<x> = 1 to 16 :CHANNEL1:RMATH:VARIABLE 1 :CHANNEL1:RMATH:VARIABLE? -> :CHANNEL1:RMATH:VARIABLE 1 This command is valid on models with the /G3 /G5 option. !<<x>:RMATh:VDIV Sets or queries the value/div setting of the</x></x></x></boolean></x></pre>
Syntax Example Description :CHANne Function	<pre>channel when real time math is turned on). :CHANnel<x>:RMATh: VARiable {<boolean>} :CHANnel<x>:RMATh:VARiable? <x> = 1 to 16 :CHANNEL1:RMATH:VARIABLE 1 :CHANNEL1:RMATH:VARIABLE? -> :CHANNEL1:RMATH:VARIABLE 1 This command is valid on models with the /G3 /G5 option. </x></x></boolean></x></pre>
Syntax Example Description :CHANne Function	<pre>channel when real time math is turned on). :CHANnel<x>:RMATh: VARiable {<boolean>} :CHANnel<x>:RMATh:VARiable? <x> = 1 to 16 :CHANNEL1:RMATH:VARIABLE 1 :CHANNEL1:RMATH:VARIABLE? -> :CHANNEL1:RMATH:VARIABLE 1 This command is valid on models with the /G3 /G5 option. </x></x></boolean></x></pre>
Syntax Example Description :CHANne Function Syntax	<pre>channel when real time math is turned on). :CHANnel<x>:RMATh: VARiable {<boolean>} :CHANnel<x>:RMATh:VARiable? <x> = 1 to 16 :CHANNEL1:RMATH:VARIABLE 1 :CHANNEL1:RMATH:VARIABLE? -> :CHANNEL1:RMATH:VARIABLE 1 This command is valid on models with the /G3 /G5 option.</x></x></boolean></x></pre>
Syntax Example Description : CHANne Function Syntax	<pre>channel when real time math is turned on). :CHANnel<x>:RMATh: VARiable {<boolean>} :CHANnel<x>:RMATh:VARiable? <x> = 1 to 16 :CHANNEL1:RMATH:VARIABLE 1 :CHANNEL1:RMATH:VARIABLE? -> :CHANNEL1:RMATH:VARIABLE 1 This command is valid on models with the /G3 /G5 option.</x></x></boolean></x></pre>
Syntax Example Description : CHANne Function Syntax	<pre>channel when real time math is turned on). :CHANnel<x>:RMATh: VARiable {<boolean>} :CHANnel<x>:RMATh:VARiable? <x> = 1 to 16 :CHANNEL1:RMATH:VARIABLE 1 :CHANNEL1:RMATH:VARIABLE? -> :CHANNEL1:RMATH:VARIABLE 1 This command is valid on models with the /G3 /G5 option. CHANnel: RMATh:VDIV Sets or queries the value/div setting of the specified RMath channel (the specified channer when real time math is turned on). :CHANnel<x>:RMATh:VDIV {<nrf>} :CHANnel<x>:RMATh:VDIV? <x> = 1 to 16</x></x></nrf></x></x></x></boolean></x></pre>
Syntax Example Description : CHANne Function Syntax	<pre>channel when real time math is turned on). :CHANnel<x>:RMATh: VARiable {<boolean>} :CHANnel<x>:RMATh:VARiable? <<x> = 1 to 16 :CHANNEL1:RMATH:VARIABLE 1 :CHANNEL1:RMATH:VARIABLE? -> :CHANNEL1:RMATH:VARIABLE 1 This command is valid on models with the /G3 /G5 option. </x></x></boolean></x></pre>
Syntax Example Description : CHANne Function Syntax Example	<pre>channel when real time math is turned on). :CHANnel<x>:RMATh: VARiable {<boolean>} :CHANnel<x>:RMATh:VARiable? <x> = 1 to 16 :CHANNEL1:RMATH:VARIABLE 1 :CHANNEL1:RMATH:VARIABLE? -> :CHANNEL1:RMATH:VARIABLE 1 This command is valid on models with the /G3 /G5 option. !</x></x></boolean></x></pre>
Syntax Example Description : CHANne Function Syntax Example	<pre>channel when real time math is turned on). :CHANnel<x>:RMATh: VARiable {<boolean>} :CHANnel<x>:RMATh:VARiable? <x> = 1 to 16 :CHANNEL1:RMATH:VARIABLE 1 :CHANNEL1:RMATH:VARIABLE? -> :CHANNEL1:RMATH:VARIABLE 1 This command is valid on models with the /G3 /G5 option. L<x>:RMATh:VDIV Sets or queries the value/div setting of the specified RMath channel (the specified channe when real time math is turned on). :CHANnel<x>:RMATh:VDIV {<nrf>} :CHANnel<x>:RMATh:VDIV {<nrf>} :CHANnel<x>:RMATh:VDIV? <x> = 1 to 16 <nrf> = 1e-20 to 5e20 :CHANNEL1:RMATH:VDIV 1E1 :CHANNEL1:RMATH:VDIV?</nrf></x></x></nrf></x></nrf></x></x></x></x></boolean></x></pre>
Syntax Example Description : CHANne Function Syntax Example	<pre>channel when real time math is turned on). :CHANnel<x>:RMATh: VARiable {<boolean>} :CHANnel<x>:RMATh:VARiable? <x> = 1 to 16 :CHANNEL1:RMATH:VARIABLE 1 :CHANNEL1:RMATH:VARIABLE? -> :CHANNEL1:RMATH:VARIABLE 1 This command is valid on models with the /G3 /G5 option. L<x>:RMATh:VDIV Sets or queries the value/div setting of the specified RMath channel (the specified channe when real time math is turned on). :CHANnel<x>:RMATh:VDIV {<nrf>} :CHANnel<x>:RMATh:VDIV {<nrf>} :CHANnel<x>:RMATh:VDIV {<nrf>} :CHANnel<x>:RMATh:VDIV 1E1 :CHANNEL1:RMATH:VDIV 1E1</x></nrf></x></nrf></x></nrf></x></x></x></x></boolean></x></pre>
Syntax Example Description : CHANne Function Syntax Example Description	<pre>channel when real time math is turned on). :CHANnel<x>:RMATh: VARiable {<boolean>} :CHANnel<x>:RMATh:VARiable? <x> = 1 to 16 :CHANNEL1:RMATH:VARIABLE 1 :CHANNEL1:RMATH:VARIABLE? -> :CHANNEL1:RMATH:VARIABLE 1 This command is valid on models with the /G3 /G5 option. !<x>:RMATh:VDIV</x> Sets or queries the value/div setting of the specified RMath channel (the specified channe when real time math is turned on). :CHANnel<x>:RMATh:VDIV Sets or queries the value/div setting of the specified RMath channel (the specified channe when real time math is turned on). :CHANnel<x>:RMATh:VDIV {<nrf>} :CHANnel<x>:RMATh:VDIV {<nrf>} :CHANNEL1:RMATH:VDIV 1E1 :CHANNEL1:RMATH:VDIV 1E1 This command is valid on models with the /G3</nrf></x></nrf></x></x></x></x></boolean></x></pre>

:CHANnel<x>:RMATh:ZOOM

Function	Sets or queries the vertical zoom factor of the specified RMath channel (the specified channel when real time math is turned on).				
Syntax	:CHANnel <x>:RMATh:ZOOM {<nrf>}</nrf></x>				
	:CHANnel <x>:RMATh:ZOOM?</x>				
	<x> = 1 to 16</x>				
	<nrf> = 0.1, 0.111, 0.125, 0.143, 0.167, 0.2, 0.25,</nrf>				
	0.33, 0.4, 0.5, 0.556, 0.625, 0.667, 0.714,				
	0.8, 0.833, 1, 1.11, 1.25, 1.33, 1.43, 1.67,				
	2, 2.22, 2.5, 3.33, 4, 5,6.67, 8, 10, 12.5,				
	16.7, 20, 25, 40, 50, 100				
Example	:CHANNEL1:RMATH:ZOOM 5				
	:CHANNEL1:RMATH:ZOOM?				
	-> :CHANNEL1:RMATH:ZOOM 5				
Description	This command is valid on models with the /G3 or				
	/G5 option.				

6

Error Messages

Messages

Messages may appear on the screen during operation. This section describes the error messages and how to respond to them. You can display the messages in the language that you specify through the operations explained section 18.5 in user's manual, IM DL850E-02EN.

Execution Errors

Code	Message	Page
722	Cannot execute search because RealTime math mode is changed after acquisition.	—

Setup Errors

Code	Message	Page	
886	Cannot set RealTime Math mode to ON due to the following problems.	1-23	
	-The slot is installed 720220, 720221, 720240,720241, 720242 or 720243.		
	-There are not any input which can be set to source for RealTime Math.		
887	There are not any modules which can be set to source for this operation.	1-23	
888	Cannot set RealTime Math mode to ON while RealTime Math Function is disable.	3-3	

Appendix 1 Digital Filter and Real Time Math

Digital Filter Operation Type

The DL850E/DL850EV has the following two digital filter operation types.

- FIR
- IIR

FIR

The signal block diagram for math that uses an FIR digital filter is shown below. The FIR filter has the following features:

1. A steep, high-order filter can be achieved within the range of the math time.

However, as the order becomes higher, the math delay becomes longer.

2. Because the filter has linear phase characteristics, it has a constant group delay. Therefore, it has a small amount of phase distortion.

In real time math, the following filters can be used as FIR filters:

- · Sharp
- Gauss
- Mean

Signal Block Diagram of an FIR Filter



IIR

The signal block diagram for math that uses an IIR digital filter is shown below. The IIR filter has the following features:

- 1. Even with comparatively low orders, the filter can obtain sufficient cutoff characteristics. Therefore, the math delay and group delay are small compared to FIR.
- 2. The frequency can be set to a lower value than is possible with FIR.
- 3. Because it has non-linear phase characteristics, the phase distortion of an IIR filter is greater than that of an FIR filter.

In real time math, a Butterworth filter, which has characteristics similar to an analog filter, can be used as an IIR filter.

Signal Block Diagram of an IIR Filter



Filter Features

The features of each filter are listed below.

Туре	Features					Band	Operation Type	
Sharp	Frequency characteristics with a sharp attenuation slope (-40 dB at 1 oct)					Low-Pass	FIR	
	Linear pha	ase and constant group delay	,		,	High-Pass		
	Ripples pr	esent in the passband				Band-Pass		
	Comb-sha	ped stopband						
Gauss	Frequency characteristics with a smooth attenuation slope				Low-Pass	FIR		
	Linear pha	ase and constant group delay	,					
	No ripples	present in the passband						
	No oversh	oot in the step response						
	Low order	and short delay						
Mean	Comb-sha	ped frequency characteristic	S			Low-Pass	FIR	
	Linear pha	ase and constant group delay	,					
	No oversh	oot in the step response						
lir	Attenuatio	n slope steepness between t	hose of the S	Sharp and Ga	uss filters	Low-Pass	lir	
(Butterworth)	Non-linear	phase and non-constant gro	oup delay			High-Pass		
	No ripples	present in the passband and	Band-Pass					
	Compared	Compared to Sharp and Gauss filters, low cutoff frequency possible						
	Character	istics similar to those of analo	og filters					
IIR-Lowpass	Frequency	characteristics with a smoot	h attenuation	n slope		Low-Pass	lir	
	Computes at 10 MS/s regardless of the setting.							
	Non-linear	phase						
	Character	istics similar to those of analo	og filters					
	Passband		Stopband					
Туре	Ripple	Attenuation Slope	Attenuation	Phase	Selectab	ole Cutoff Ra	nge	
Sharp	0 dB	–40 dB at 1 oct (Low-Pass)						
		-40 dB at -1 oct (High-Pass)	–40 dB	Linear phase	2 to 30%	of the calculati	on frequency	
Gauss	±0.3 dB	$-3.0 \times (f/fc)^2 dB$		Linear phase	2 to 30%	of the calculati	on frequency	
Mean	0 dB	See the characteristics graph		Linear phase	—			
IIR	0 dB	–24 dB at 1 oct (Low-Pass)						
(Butterworth)		-24 dB at -1 oct (High-Pass)		Non-linear	0.2 to 30%	6 of the calcula	ation	
				phase	frequency			
IIR-Lowpass	0 dB	-12 dB at -1 oct		Non-linear				
				phase				

About the Group Delay Characteristic

In the filter response characteristics, the delay (in seconds) between the input frequency (sine wave) and the output frequency is known as group delay. The group delay can be normalized by the calculation period (Ts). Group delay is expressed in units of s/Ts. The length of the group delay for each frequency can be determined by the following equation: "group delay of the frequency × calculation period."

Example

The length of the group delay for the mean can be calculated as shown below (the group delay is constant, regardless of the frequency).

Group delay (in s/Ts) when the mean filter is used = (number of mean points -1)/2

If there are 16 mean points,

Group delay (in s/Ts) = (16 - 1)/2 = 15/2 = 7.5 s/Ts.

If the calculation frequency (fs) is 100 kHz,

Ts = $1/fs = 1/(100 \text{ kHz}) = 10 \text{ }\mu\text{s}.$

Therefore,

Length of delay = Group delay × calculation period = 7.5 s/Ts × 10 μ s = 75 μ s.

About the Calculation Frequency

With the digital filter and IIR filter of real time math, the calculation frequency is automatically set internally depending on the cutoff frequency. Once per calculation period—which is determined from this calculation frequency—simple decimation is performed on the data, and the filter operation is performed, so the filter calculation results are updated once per calculation period. The calculation frequencies are shown below.

Calculation Frequency
1 MHz
100 kHz
10 kHz
1 kHz
100 Hz

Real Time Math IIR Filter	
Cutoff Frequency Range	Calculation Frequency
3 MHz to 300 kHz	10 MHz
298 kHz to 30 kHz	1 MHz
29.8 kHz to 3 kHz	100 kHz
2.98 kHz to 300 Hz	10 kHz
298 Hz to 30 Hz	1 kHz
29.8 Hz or less	100 Hz

About the Math Delay

The math delay can be calculated from the following equation.

Math delay = 1.4 µs + digital filter delay + math time

If you are not using the digital filter and math features, the delay and math time both become 0. The digital filter delay varies depending on the filter type and the calculation frequency. For details on

the delay, see each filter's math delay explanation.

The math time is different for each function. A table of the math times for each function is shown below.

Function	Math Time (µs)	Notes
S1+S2	0.0	
S1–S2	0.0	
S1*S2	0.0	
S1/S2	0.0	
A(S1)+B(S2)+C	0.0	
A(S1)–B(S2)+C	0.0	
A(S1)*B(S2)+C	0.0	
A(S1)/B(S2)+C	0.0	
Diff	See the filter explan	ations.
Integ1	0.2	
Integ2	0.2	
Angle	0.2	
DA	0.2	
Polynomial	0.8	The data is updated once per microsecond.
RMS	0.6	The data is updated once per the specified period.
Power	0.4	The data is updated once per the specified period.
Power Integ	0.2	
Log1	0.4	
Log2	0.2	
Sqrt1	0.2	
Sqrt2	0.0	
Cos	0.2	
Sin	0.2	
Atan	0.3	
Electric Angle	1.1	The data is updated once per the specified period.
Knocking Filter	0.0	
Poly-Add-Sub	0.0	
Frequency	0.2	The data is updated each time that an edge is detected.
Period	0.2	The data is updated each time that an edge is detected.
Edge Count	0.2	The data is updated each time that an edge is detected.
Resolver	0.4	The data is updated once per excitation voltage period.
IIR Filter	See the filter explan	ations.
PWM	0.2	
Reactive Power	0.2	
CAN ID	The calculation period	od is from the last bit sample point of the CAN frame ID to the point of
	detection. The samp	le point is approximately at the 70% point of the time span of a bit.
Torque	0.4	The data is updated each time that an edge is detected.
S1–S2(Angle)	0.0	
3 Phase Resolver	0.4	The data is updated once per excitation voltage period.

Sharp Filter

Characteristics

Low-Pass and High-Pass

- The ripple that is present in the passband is within 0.3 dB.
- When the frequency is equal to the cutoff frequency times 2 for low-pass or the cutoff frequency times 0.5 for high-pass, the attenuation is set to -40 dB.
- The stopband attenuation is -40 dB or greater.
- The filter has linear phase and constant group delay.

Sharp Low-Pass Frequency Characteristics Example



Band-Pass

- The ripple that is present in the passband is within 0.3 dB.
- In the low frequency band, when the frequency becomes half the frequency that was present at edge fcl of the passband, the attenuation is set to -40 dB.
- In the high frequency band, the width of the transition area, in which the frequency is attenuated -40 dB from the passband edge, is approximately the same as the width of the transition area in the low frequency band.
 - (fcl 1/2fcl = fcus fcu)
- The stopband attenuation is -40 dB or greater.
- The filter has linear phase and constant group delay.



In the Sharp band-pass filter, the bandwidth options vary depending on the center frequency.

Center Frequency (kHz)	Bandwidth Setting (kHz)	Calculation Frequency (Hz)
300 to 120	200, 150, 100, 50, 20	1 M
118 to 96	150, 100, 50, 20	1 M
94 to 70	100, 50, 20	1 M
68 to 46	50, 20	1 M
44 to 30	20	1 M
29.8 to 12	20, 15, 10, 5, 2	100 k
11.8 to 9.6	15, 10, 5, 2	100 k
9.4 to 7	10, 5, 2	100 k
6.8 to 4.6	5, 2	100 k
4.4 to 3	2	100 k
2.98 to 1.2	2, 1.5, 1, 0.5, 0.2	10 k
1.18 to 0.96	1.5, 1, 0.5, 0.2	10 k
0.94 to 0.7	1, 0.5, 0.2	10 k
0.68 to 0.46	0.5, 0.2	10 k
0.44 to 0.3	0.2	10 k

Sharp Band-Pass Filter Frequency Range

Order Tables

The orders of each Sharp filter are listed below. The cutoff and center frequency settings are given as percentages of the calculation frequency.

Sharp Low-Pass Filter Orders

Cutoff frequency	2%	3%	4%	5%	6%	7%	8%	9%	10%
Order	94	61	46	37	32	28	24	22	20
Cutoff frequency	11%	12%	13%	14%	15%	16%	17%	18%	19%
Order	17	17	15	14	13	13	11	11	11
Cutoff frequency	20%	21%	22%	23%	24%	25%	26%	27%	28%
Order	10	11	9	9	8	8	8	8	8
Cutoff frequency	29%	30%							
Order	8	8							

Sharp High-Pass Filter Orders

Cutoff frequency	2%	3%	4%	5%	6%	7%	8%	9%	10%
Order	191	127	97	77	65	55	49	45	39
Cutoff frequency	11%	12%	13%	14%	15%	16%	17%	18%	19%
Order	37	33	31	29	27	25	25	23	23
Cutoff frequency	20%	21%	22%	23%	24%	25%	26%	27%	28%
Order	21	21	19	19	19	17	17	17	15
Cutoff frequency	29%	30%							
Order	15	15							

Sharp Band-Pass Filter Orders (Passband width: 2%)

Center frequency	3%	4%	5%	6%	7%	8%	9%	10%	11%
Order	189	142	93	80	69	61	54	49	45
Center frequency	12%	13%	14%	15%	16%	17%	18%	19%	20%
Order	41	37	34	32	27	20	18	18	17
Center frequency	21%	22%	23%	24%	25%	26%	27%	28%	29%
Order	16	16	14	14	14	13	13	12	13
Center frequency	30%								
Order	11								

Sharp Band-Pass Filter Orders (Passband width: 5%)

					-			
5%	6%	7%	8%	9%	10%	11%	12%	13%
154	112	93	72	64	58	51	40	37
14%	15%	16%	17%	18%	19%	20%	21%	22%
35	33	31	29	28	26	25	24	23
23%	24%	25%	26%	27%	28%	29%	30%	
22	21	20	19	19	18	17	18	
	5% 154 14% 35 23% 22	5% 6% 154 112 14% 15% 35 33 23% 24% 22 21	5% 6% 7% 154 112 93 14% 15% 16% 35 33 31 23% 24% 25% 22 21 20	5%6%7%8%154112937214%15%16%17%3533312923%24%25%26%22212019	5%6%7%8%9%15411293726414%15%16%17%18%353331292823%24%25%26%27%2221201919	5%6%7%8%9%10%1541129372645814%15%16%17%18%19%35333129282623%24%25%26%27%28%222120191918	5% 6% 7% 8% 9% 10% 11% 154 112 93 72 64 58 51 14% 15% 16% 17% 18% 19% 20% 35 33 31 29 28 26 25 23% 24% 25% 26% 27% 28% 29% 22 21 20 19 19 18 17	5%6%7%8%9%10%11%12%15411293726458514014%15%16%17%18%19%20%21%353331292826252423%24%25%26%27%28%29%30%2221201919181718

Sharp Band-Pass Filter Orders (Passband width: 10%)

7%	8%	9%	10%	11%	12%	13%	14%	15%
194	132	97	78	69	57	52	47	39
16%	17%	18%	19%	20%	21%	22%	23%	24%
37	35	33	31	30	28	27	23	23
25%	26%	27%	28%	29%	30%			
20	19	18	18	17	16			
	7% 194 16% 37 25% 20	7% 8% 194 132 16% 17% 37 35 25% 26% 20 19	7% 8% 9% 194 132 97 16% 17% 18% 37 35 33 25% 26% 27% 20 19 18	7% 8% 9% 10% 194 132 97 78 16% 17% 18% 19% 37 35 33 31 25% 26% 27% 28% 20 19 18 18	7%8%9%10%11%19413297786916%17%18%19%20%373533313025%26%27%28%29%2019181817	7%8%9%10%11%12%1941329778695716%17%18%19%20%21%37353331302825%26%27%28%29%30%201918181716	7% 8% 9% 10% 11% 12% 13% 194 132 97 78 69 57 52 16% 17% 18% 19% 20% 21% 22% 37 35 33 31 30 28 27 25% 26% 27% 28% 29% 30%	7% 8% 9% 10% 11% 12% 13% 14% 194 132 97 78 69 57 52 47 16% 17% 18% 19% 20% 21% 22% 23% 37 35 33 31 30 28 27 23 25% 26% 27% 28% 29% 30%

Sharp Band-Pass Filter Orders (Passband width: 15%)

Center frequency	10%	11%	12%	13%	14%	15%	16%	17%	18%
Order	155	110	89	73	62	52	49	41	38
Center frequency	19%	20%	21%	22%	23%	24%	25%	26%	27%
Order	36	34	32	27	26	25	24	23	22
Center frequency	28%	29%	30%						
Order	21	21	21						

Appendix 1 Digital Filter and Real Time Math

enarp Bana i a				osana					
Center frequency	12%	13%	14%	15%	16%	17%	18%	19%	20%
Order	191	129	98	78	67	58	49	46	40
Center frequency	21%	22%	23%	24%	25%	26%	27%	28%	29%
Order	38	36	31	29	28	27	26	25	24
Center frequency	30%								
Order	20								

Sharp Band-Pass Filter Orders (Passband width: 20%)

Math Delay

The group delay can be calculated from the following equation. The group delay is constant based on the filter order.

Group delay = (filter order - 1)/2

Unit: s/Ts (Ts is the calculation period in seconds)

The math delay can be calculated from the following equation. Math delay = $1.4 \ \mu s + \{(\text{filter order} - 1)/2\} \times \text{calculation period}$

Examples of Characteristics







(f: Calculation frequency in Hz)



Sharp Band-Pass (Passband width: 2%)





Sharp Band-Pass (Passband width: 5%) Sharp Band-Pass Frequency Characteristics (Passband width: 5%)



(f: Calculation frequency in Hz)



Sharp Band-Pass (Passband width: 15%)





Sharp Band-Pass (Passband width: 20%)



(f: Calculation frequency in Hz)
Gauss Filter

Characteristics

- The passband is flat.
- At the cutoff frequency, the attenuation is -3 dB. The damping rate is $-3.0 \times (f/fc)^2$.
- The filter has linear phase and constant group delay.
- The filter can only be set to low-pass.



Order Table

The orders of the Gauss filter are shown below. The cutoff frequency settings are given as percentages of the calculation frequency.

Gauss Filter Orders

Cutoff frequency	2%	3%	4%	5%	6%	7%	8%	9%	10%
Order	49	33	25	21	17	17	13	13	9
Cutoff frequency	11%	12%	13%	14%	15%	16%	17%	18%	19%
Order	9	9	9	9	9	9	5	5	5
Cutoff frequency	20%	21%	22%	23%	24%	25%	26%	27%	28%
Order	5	5	5	5	5	5	5	5	5
Cutoff frequency	29%	30%							
Order	5	5							

Math Delay

The group delay can be calculated from the following equation. The group delay is constant based on the filter order.

Group delay = (filter order - 1)/2

Unit: s/Ts (Ts is the calculation period in seconds)

The math delay can be calculated from the following equation. Math delay = $1.4 \ \mu s + \{(filter \ order - 1)/2\} \times calculation \ period$





IM DL850E-51EN

IIR (Butterworth)

Characteristics

Low-Pass and High-Pass

- This is a fourth order Butterworth filter. The damping rate is approximately -24 dB/oct.
- The passband is flat.

0f

0.1f

1/2fc

- At the cutoff frequency, the attenuation is -3 dB.
- · It has non-linear phase characteristics.
- You can set the frequency lower than other FIR filters.



0.2f

fc

0.3f

0.4f

(f: Calculation frequency in Hz)

0.5f

Band-Pass

- The passband is flat.
- At each end of the passband, the attenuation is -3 dB.
- This is a fourth order Butterworth filter. There are no ripples present in the stopband. For the cutoff characteristic, see "Examples of Characteristics" later in this section.
- It has non-linear phase characteristics.
- You can set the frequency lower than the Sharp filter.



In the IIR (Butterworth) band-pass filter, the bandwidth options vary depending on the center frequency.

Center Frequency (kHz)	Bandwidth Setting (kHz)	Calculation Frequency (Hz)
300 to 102	200, 150, 100, 50, 20, 10	1 M
100 to 76	150, 100, 50, 20, 10	1 M
74 to 52	100, 50, 20, 10	1 M
50 to 26	50, 20, 10	1 M
24 to 12	20, 10	1 M
11.8 to 10.2	20, 15, 10, 5, 2, 1	100 k
10 to 7.6	15, 10, 5, 2, 1	100 k
7.4 to 5.2	10, 5, 2, 1	100 k
5 to 2.6	5, 2, 1	100 k
2.4 to 1.2	2, 1	100 k
1.18 to 1.02	2, 1.5, 1, 0.5, 0.2, 0.1	10 k
1 to 0.76	1.5, 1, 0.5, 0.2, 0.1	10 k
0.74 to 0.52	1, 0.5, 0.2, 0.1	10 k
0.5 to 0.26	0.5, 0.2, 0.1	10 k
0.24 to 0.12	0.2, 0.1	10 k
0.1 to 0.06	0.1	10 k

IIR (Butterworth) Band-Pass Filter Frequency Ranges

Math Delay

With IIR filters, unlike FIR filters, you cannot define the math delay. This is because the delay varies depending on the input frequency because of the non-linear phase characteristics of IIR filters. The group delay characteristic indicates the relationship between the frequency of the input signal and the math delay. The math delay can be calculated by adding 1.4 us to the group delay characteristic.

The math delay can be calculated from the following equation. Math delay = $(1.4 \ \mu s + group \ delay) \times calculation \ period$

Examples of Characteristics

IIR (Butterworth) Low-Pass

IIR (Butterworth) Low-Pass Frequency Characteristics



IIR (Butterworth) Low-Pass Group Delay Characteristics (1)



IIR (Butterworth) Low-Pass Group Delay Characteristics (2)









15%

0.2f

4

2

0 ∟ 0f

0.1f

20%<u>_25%</u>

0.3f

30%

0.4f

(f: Calculation frequency in Hz)

0.5f

IIR (Butterworth) Band-Pass (Passband width: 1%)

IIR (Butterworth) Band-Pass Frequency Characteristics (Passband width: 1%)



IIR (Butterworth) Band-Pass Group Delay Characteristics (1; passband width: 1%)



IIR (Butterworth) Band-Pass Group Delay Characteristics (2; passband width: 1%)



App-17

IIR (Butterworth) Band-Pass (Passband width: 2%)

IIR (Butterworth) Band-Pass Frequency Characteristics (Passband width: 2%)



IIR (Butterworth) Band-Pass Group Delay Characteristics (1; passband width: 2%)



IIR (Butterworth) Band-Pass Group Delay Characteristics (2; passband width: 2%)





IIR (Butterworth) Band-Pass Frequency Characteristics (Passband width: 5%)



IIR (Butterworth) Band-Pass Group Delay Characteristics (1; passband width: 5%)



IIR (Butterworth) Band-Pass Group Delay Characteristics (2; passband width: 5%)



IIR (Butterworth) Band-Pass (Passband width: 10%)

IIR (Butterworth) Band-Pass Frequency Characteristics (Passband width: 10%)



IIR (Butterworth) Band-Pass Group Delay Characteristics (1; passband width: 10%)



IIR (Butterworth) Band-Pass Group Delay Characteristics (2; passband width: 10%)





IIR (Butterworth) Band-Pass Frequency Characteristics (Passband width: 15%)



IIR (Butterworth) Band-Pass Group Delay Characteristics (1; passband width: 15%)



IIR (Butterworth) Band-Pass Group Delay Characteristics (2; passband width: 15%)



IIR (Butterworth) Band-Pass (Passband width: 20%)

IIR (Butterworth) Band-Pass Frequency Characteristics (Passband width: 20%)



IIR (Butterworth) Band-Pass Group Delay Characteristics (1; passband width: 20%)



IIR (Butterworth) Band-Pass Group Delay Characteristics (2; passband width: 20%)



Mean Filter

Characteristics

- The passband is flat.
- The filter has linear phase and constant group delay.
- The characteristics are those of a low-pass filter.
- The filter has comb-shaped bandwidth characteristics.



Math Delay

The group delay can be calculated from the following equation. The group delay is constant based on the filter order.

Group delay = (number of mean points - 1)/2

Unit: s/Ts (Ts is the calculation period in seconds)

The math delay can be calculated from the following equation.

Math delay = 1.4 μ s + {(number of mean points – 1)/2} × calculation period

IIR-Lowpass Filter

Characteristics

- The passband is flat.
- It has non-linear phase characteristics.

Frequency characteristics







Real Time Math Differentiation

Differentiation Characteristics

The real time math differentiation operation uses a fifth order Lagrange interpolation formula to calculate the differentiated value. The fifth order Lagrange interpolation formula is shown below (see page 5 in the appendix of the *Features Guide*, IM DL850E-01EN).

 $fn' = 1/(12Ts){fn-4 - 8fn-3 + 8fn-1 - fn}$

The following chart shows the amplitude characteristic in the case where the fifth order Lagrange interpolation formula is used and the ideal differentiation characteristic.



Up to the point where the input frequency is 20% of the calculation period, the differentiation characteristic is almost the same as the ideal differentiation characteristic. At higher frequencies, the high frequency components are restrained by the high-area characteristics of the Lagrange interpolation formula.

Math Delay

The math delay is calculated using the following formula.

Math delay = $1.4 \ \mu s + 2 \times calculation \ period^*$

* The "2" in the above formula is the delay due to the Lagrange interpolation formula.

About the Calculation Frequency

Differentiation is calculated at the DL850E/DL850EV sampling frequency. In dual capture mode, it is calculated at the main waveform's frequency.

However, the upper calculation frequency limit is 10 MHz. If the smaller sample rate exceeds this value, the calculation frequency is set to 10 MHz.

When you are performing external sampling, the calculation frequency is fixed to 10 MHz.

About the Electrical Angle

By using the electrical angle math operation, you can calculate the phase difference between the motor's input current and the motor's angle of rotation.

By using an encoder, you can accurately measure the motor's mechanical angle of rotation, but the current waveform using this method is distorted because harmonic components are overlaid on top of it.

In situations such as this, the phase difference between the motor's mechanical angle of rotation and its current cannot be determined in a simple manner.

The real time math feature uses a discrete Fourier transform to determine the fundamental component of the current waveform, and then calculates the phase difference between this fundamental component and the motor's mechanical angle of rotation.



The phase difference is calculated with the motor's mechanical angle of rotation as the reference. If the phase is leading the motor's mechanical angle of rotation, the phase is displayed as a positive value.

Resolver

The angle of rotation is calculated from the excitation signal applied to the resolver and the sine signal and cosine signal that are generated from the detection coils of the resolver. To calculate the angle of rotation precisely, the data of the largest points (the peak values) of the carrier component of the sine and cosine signals are sampled, and the calculation is performed.



When the Sample Mode Is Set to Auto

The rising edge of the excitation signal is detected, and period T of the excitation signal is measured. The rising edges of the sine and cosine signals are also detected, and the time difference Δt between these rising edges and the rising edge of the excitation signal is measured. From period T and time difference Δt , the data at point T/4 + Δt is sampled.

- The Auto setting can be applied when the time difference ∆t of the sine and cosine signals in reference to the excitation signal is less than ±90°(T/4).
- Turn the SCALE knob to set the vertical scale (V/div) so that the amplitudes of the excitation, sine, and cosine signals are all ±1.5 div or greater. If the amplitudes are less than ±1.5 div, the Auto function will not operate.

When the Sample Mode Is Set to Manual

The rising edge of the excitation signal is detected, and the data at the point at the specified time after this detected rising edge is sampled.

Tracking Filter

Because the resolver generates discrete signals, the calculation results are also discrete. The DL850E/DL850EV can use a tracking filter to convert the results into a smooth, continuous wave. The tracking filter has a low pass filter. If you set a high cutoff frequency, you can measure a signal that has faster rotations and a higher angular acceleration (change in the number of rotations). On the other hand, the stability and angle resolution in measurements during constant velocity rotations decrease.

The relationship between cutoff frequency and maximum measurable angular acceleration (measurement of the change in the number of rotations) is shown below.

Cutoff Frequency	Maximum Measurable Angular Acceleration
2kHz	140000rps ²
1kHz	54000rps ²
250kHz	1800rps ²
100Hz	180rps ²

When the rotation is fast, if you specify a low cutoff frequency, the DL850E/DL850EV may not be able to calculate the angle correctly. In this situation, set the cutoff frequency to a higher value.

Math Flowchart and Internal Math Expressions of Real Time Math

The math flowchart of real time math is shown below. The real time math I/O is 16-bit binary data (if the input is only 12 bits in length, it is converted to 16 bits).

Internally, real time math is performed on 32-bit floating point data, so I/O data is converted with 1 LSB weight.

Note that 16-bit binary output data is converted with the 1 LSB weight that is determined by value/div. The I/O data is normalized to 2400 LSB/div when displayed on the screen.

Math Input: Conversion of 16-Bit Binary Data to Floating-Point Data

Math source data is acquired into real time math, and at the same time, is converted with 1 LSB weight into floating-point format.

A (float) = A (binary) × (1 LSB weight) B (float) = B (binary) × (1 LSB weight)

Internal Math

All internal real time math operations are performed using floating-point data. Example: C (float) = A (float) + B (float)

Calculation of the 1 LSB Weight of the Output

The 1 LSB weight of the output is determined from the real time math range (value/div). Because 1 div = 2400 LSB,

1 LSB weight of the output = (value/div)/2400.

Math Output: Conversion of Floating-Point Data to 16-Bit Binary Data

The output is converted to 16-bit data through the following formula. C (binary) = C (float)/(1 LSB weight)



Power Analysis Equation (For Each Source Channel)

Urms, Irms (True Rms Value, RMS)

These values are the true rms values of the voltage and current. The instantaneous values over one period are squared and averaged. Then, the square root of the value is determined. u(n) is the instantaneous voltage, i(n) is the instantaneous current, n is the nth calculation period based on the synchronization source setting, and T is the number of samples.

Urms =
$$\sqrt{\frac{1}{T} \int_0^T u(n)^2 dt}$$
 Irms = $\sqrt{\frac{1}{T} \int_0^T i(n)^2 dt}$

Umn, Imn (Rectified Mean Value Calibrated to the Rms Value, MEAN)

This function rectifies one period of the voltage or current signal, determines the average, and multiplies the result by a coefficient. The coefficient is a value that when applied to a sinusoidal input signal, gives the true rms value. When the input signal is a distorted or is a DC waveform, these values will differ from the true rms values. u(n) is the instantaneous voltage, i(n) is the instantaneous current, n is the nth calculation period based on the synchronization source setting, and T is the number of samples.

Umn =
$$\frac{\pi}{2\sqrt{2}} \cdot \frac{1}{T} \int_0^T |u(n)| dt$$
 Irms = $\frac{\pi}{2\sqrt{2}} \cdot \frac{1}{T} \int_0^1 |i(n)| dt$

Note_

You can select RMS or MEAN on the DL850E/DL850EV. Regardless of which you select, the values are displayed as Urms and Irms on the DL850E/DL850EV screen.

Udc, Idc (Simple Average, DC)

These are the average values over one period of the voltage and current signals. This function is useful when determining the average value of a DC input signal or a DC component that is superimposed on an AC input signal. u(n) is the instantaneous voltage, i(n) is the instantaneous current, n is the nth calculation period based on the synchronization source setting, and T is the number of samples.

$$Udc = \frac{1}{T} \int_0^T u(n) dt \quad Idc = \frac{1}{T} \int_0^T i(n) dt$$

Uac, lac (AC Component, AC)

These are the AC components of the voltage and current. They are the square root values of the difference of the square of the true rms values of the input signal and the square of the DC component.

 $Uac = \sqrt{Urms^2 - Udc^2}$ $Iac = \sqrt{Irms^2 - Idc^2}$

P (Active Power)

This value is determined by multiplying together the instantaneous voltages and currents over one period and taking the average. u(n) is the instantaneous voltage, i(n) is the instantaneous current, n is the nth calculation period based on the synchronization source setting, and T is the number of samples.

$$\mathbf{P} = \frac{1}{T} \int_0^T \mathbf{u}(\mathbf{n}) \cdot \mathbf{i}(\mathbf{n}) \, \mathrm{d}\mathbf{t}$$

S (Apparent Power)

This value is determined by multiplying together the rms voltages and currents over one period.

P = Urms•Irms

Q (Reactive Power)

This the square root of the difference of the square of the apparent power and the square of the active power over one period. s is the sign for the lead and lag of each source channel. It is negative when the current leads the voltage. It is positive when the current rags the voltage.

$$Q=s\sqrt{S^2-P^2}$$

λ (power factor)

This value is determined by dividing the active power by the apparent power over one period.

$$\lambda = \frac{P}{S}$$

φ (Phase Angle)

This is the arc cosine (cos⁻¹) of the value obtained by dividing the active power by the apparent power over one period. It is negative when the current leads the voltage. It is positive when the current rags the voltage.

$$\varphi = \cos^{-1}\left(\frac{\mathsf{P}}{\mathsf{S}}\right)$$

WP (Integrated Power), WP+ (Positive Integrated Power: Consumed Watt-Hours), WP- (Negative Integrated Power: Watt-Hours Returned to the Power Supply)

These values are determined by multiplying together the instantaneous voltages and currents and integrating them for the number of samples.

WP, WP+, or WP- =
$$\int_0^T u(n) \cdot i(n) dt$$

q (Integrated Ampere-Hour), q+ (Positive Integrated Ampere-Hour), q- (Negative Integrated Ampere-Hour)

These values are determined by integrating the currents for the number of samples.

$$q = \int_0^T Irms dt \quad q+, q- = \int_0^T i(n) dt$$

WS (Volt-Ampere Hours)

This value is determined by multiplying together the rms voltages and currents over one period and integrating them for the number of samples.

WS =
$$\int_0^T \text{Urms} \cdot \text{Irms dt}$$

WQ (Var Hours)

This value is determined by taking the square root of the difference of the square of the apparent power and the square of the active power over one period and integrating them for the number of samples.

$$WQ = \int_0^T s\sqrt{S^2 - P^2} dt$$

Impedance (Z)

This value is determined by dividing the rms voltages and currents over one period.

 $Z = \frac{Urms}{Irms}$

Series Resistance (RS)

This value is determined by dividing the active power over one period by the square of the rms current.

P Irms²

Series Reactance (XS)

This value is determined by dividing the reactive power over one period by the square of the rms current.

Q Irms²

Parallel Resistance (RP)

This value is determined by dividing the square of the rms voltage by the active power over one period.

 $\frac{\text{Urms}^2}{\text{P}}$

Parallel Reactance (XP)

This value is determined by dividing the square of the rms voltage by the reactive power over one period.

Urms² Q

Three-Phase Unbalance Factor

This is determined by the following equation. The three-phase unbalance factor can be calculated only when the wiring system is set to 3P3W(3V3A), 3P4W, $3P3W \rightarrow 3P3W(3V3A)$, $3P3W(3V3A) \rightarrow 3P4W$, or $3P4W \rightarrow 3P3W(3V3A)$.

Three-Phase Voltage Unbalance Factor

With respect to line voltages Urs, Ust, and Utr (rms),

Three-phase voltage unbalance factor
$$K = \frac{U_2}{U_1} \times 100\%$$

where

 $U_{1} = \sqrt{(1/6)(Urs^{2}+Ust^{2}+Utr^{2}) + (2/\sqrt{3})\sqrt{Ua(Ua-Urs)(Ua-Ust)(Ua-Utr)}}$ $U_{2} = \sqrt{(1/6)(Urs^{2}+Ust^{2}+Utr^{2}) - (2/\sqrt{3})\sqrt{Ua(Ua-Urs)(Ua-Ust)(Ua-Utr)}}$ $U_{a} = \frac{(Urs+Ust+Utr)}{2}$

Three-Phase Current Unbalance Factor

With respect to currents I1, I2, and I3 (rms),

Three-phase voltage unbalance factor
$$K = \frac{l_2}{l_1} \times 100\%$$

where

 $I_{1} = \sqrt{(1/6)(I1^{2} + I2^{2} + I3^{2}) + (2\sqrt{3})\sqrt{(Ia(Ia - I1)(Ia - I2)(Ia - I3))}}$ $I_{2} = \sqrt{(1/6)(I1^{2} + I2^{2} + I3^{2}) - (2\sqrt{3})\sqrt{(Ia(Ia - I1)(Ia - I2)(Ia - I3))}}$ $I_{a} = \frac{(I1 + I2 + I3)}{2}$

The three-phase unbalance factor is calculated by determining the rms values from the following values for each sample for each wiring system.

	3P3W (3V3A)	3P4W	3P3W→ 3P3W (3V3A)	3P3W(3V3A)→ 3P4W	3P4W→ 3P3W (3V3A)
Urs	u1	u1-u2	u1	u1	u1-u2
Ust	u2	u2-u3	u2	u2	u2-u3
Utr	u3	u3-u1	u1-u2	u3	u3-u1
11	i1	i1	i1	i1	i1
12	i2	i2	i2	i2	i2
13	i3	i3	i3	i3	i3

Motor Efficiency

This value is determined by dividing the rotating speed by the total active power.

$$\eta = \frac{Pm}{P\Sigma} \times 100\%$$

Integration Time

This is the time from integration start to integration stop.

			Equa	ation						
Measurement Function (Σ Function)		Single-Phase Three-Wire (1P3W)	Three-Phase Three-Wire (3P3W)	Three-Voltage Three-Current Method (3V3A)	Three-Phase Four-Wire (3P4W)					
	Power analys	is								
	UrmsΣ	(Urms1 -	+ Urms2) / 2	(Urms1 + Urms2	+ Urms3) / 3					
	UmnΣ	(Umn1 +	+ Umn2) / 2	(Umn1 + Umn2 + Umn3) / 3						
U [V] UdcΣ		(Udc1 +	+ Udc2) / 2	(Udc1 + Udc2 + Udc3) / 3						
UacΣ		(Uac1 +	+ Uac2) / 2	(Uac1 + Uac2 + Uac3) / 3						
	Harmonic and	alysis								
	υΣ	(U1 -	+ U2) / 2	(U1 + U2 +	U3) / 3					
	Power analys	is								
	IrmsΣ	(Irms1 -	⊦ Irms2) / 2	(Irms1 + Irms2	+ Irms3) / 3					
	lmnΣ	(Imn1 +	+ lmn2) / 2	(Imn1 + Imn2 ·	+ lmn3) / 3					
I [A]	ldcΣ	(ldc1 -	+ ldc2) / 2	(Idc1 + Idc2 +	+ Idc3) / 3					
	lacΣ	(lac1 +	+ lac2) / 2	(lac1 + lac2 +	- lac3) / 3					
	Harmonic ana	alysis								
	IΣ	(11 -	+ 12) / 2	(11 + 12 +	13) / 3					
ΡΣ [W]			P1 + P2		P1 + P2 + P3					
	Power an	alysis								
SΣ [VA]		S1 + S2	$\frac{\sqrt{3}}{2}(S1 + S2)$	$\frac{\sqrt{3}}{3}$ (S1 + S2 + S3)	S1 + S2 + S3					
	Harmonio	analysis	analysis							
		$\sqrt{P\Sigma^2 + Q\Sigma^2}$								
QΣ [var]	Power an	alysis								
		$\sqrt{S\Sigma^2 - P\Sigma^2}$								
	Harmonio	canalysis Q1 + Q2 Q1 + Q2 + Q								
λΣ		<u>ΡΣ</u> SΣ								
φΣ [°]		$COS^{-1}\left(\frac{P\Sigma}{S\Sigma}\right)$ (only for power analysis)								
ΖΣ [Ω]		$\frac{S\Sigma}{Irms\Sigma^2}$ (only for power analysis)								
RSΣ [Ω]		$\frac{P\Sigma}{Irms\Sigma^2}$ (only for power analysis)								
XSΣ [Ω]			$\frac{Q\Sigma}{Irms\Sigma^2}$ (only for	power analysis)						
RPΣ [Ω] (= 1/G)			$\frac{\text{Urms}\Sigma^2}{\text{P}\Sigma}$ (only for	power analysis)						
XPΣ [Ω] (= 1/B)		$\frac{Urms\Sigma^2}{OS}$ (only for power analysis)								
η (efficie	ency 1) [%]		<u>ΡΣΒ</u> ·100 (only fo	r power analysis)						
1/η (effic	ciency 2) [%]		<u>ΡΣΑ</u> · 100 (only fo	r power analysis)						

Power Analysis Equations (Wiring Unit Σ)

Note_

- P Σ , Q Σ , and $\lambda\Sigma$ are equations that apply both to power analysis and harmonic analysis.
- Each symbol denotes the measurement function of each source channel that is determined during power analysis or harmonic analysis.
- The letters A and B of ΣA and ΣB denote the combinations of wiring systems.
- A represents Wiring System1, and B represents Wiring System2.

		(Table 1/2)					
	Methods of Determination and Equa	tion					
Measurement Function	Harmonic measurement of measurement function	Total {() none }					
Voltage Vrms [V]	$U(k) = \sqrt{u_r(k)^2 + u_j(k)^2}$	$U = \sqrt{\sum_{k=1}^{\max} U(k)^2}$					
Current Irms [A]	$I(k) = \sqrt{ir(k)^2 + i_j(k)^2}$	$I = \sqrt{\sum_{k=1}^{\max} I(k)^2}$					
Active power P [W]	$P(k) = ur(k) \cdot ir(k) + u_j(k) \cdot i_j(k)$	$\mathbf{P} = \sum_{k=1}^{\max} \mathbf{P}(k)$					
Apparent power S [VA]	_	$S = \sqrt{P^2 + Q^2}$					
Reactive power Q [var]	$Q(k) = u_r(k) \cdot i_r(k) - u_j(k) \cdot i_j(k)$	$\mathbf{Q} = \sum_{k=1}^{\max} \mathbf{Q}(k)$					
Power factor λ	_	$\lambda = \frac{P}{S}$					
	$\phi(\textbf{k})$ = (nth harmonic phase) – (fundamental phase) x k						
Phase angle φ [°]	When the source is voltage in Line RMS mode, $\tan^{-1}\left\{\frac{ur(k)}{u_j(k)}\right\} - \tan^{-1}\left\{\frac{ur(1)}{u_j(1)}\right\} \times k$ When the source is current in Line RMS mode, $\int \frac{dr(k)}{dr(k)} = \int dr(k)$	_					
	$\begin{aligned} \tan^{-1}\left\{\frac{ir(\mathbf{k})}{i_{j}(\mathbf{k})}\right\} &= \tan^{-1}\left\{\frac{ir(1)}{i_{j}(1)}\right\} \times \mathbf{k} \\ \text{When Power mode,} \\ \tan^{-1}\left\{\frac{\mathbf{Q}r(\mathbf{k})}{\mathbf{P}_{j}(\mathbf{k})}\right\} &= \tan^{-1}\left\{\frac{\mathbf{Q}r(1)}{\mathbf{P}_{j}(1)}\right\} \times \mathbf{k} \end{aligned}$						
Harmonic distortion	Calculates the ratio of the total rms value from the 2nd t to the fundamental wave.	o the 40th harmonic					
factor (IEC) THDIEC	Distortion factor (IEC) = $\int_{n=2}^{40} (nth harmonic rms voltage (or current))^2$						
	γ (fundamental rms voltage (or current)) ²					
	Calculates the ratio of the total rms value from the 2nd t to the total rms value from the fundamental to the 40th h	o the 40th harmonic armonic.					
Harmonic distortion factor (CSA) THDCSA	Distortion factor (CSA) = $\int_{\frac{n=2}{2}}^{\frac{40}{2}} (nth harmonic rms volt$	age (or current)) ²					
	$\sqrt{\sum_{n=1}^{40} (nth harmonic rms voltage (or current))^2}$						

Harmonic Analysis Equations

Note_

• k denotes a harmonic order, r denotes the real part, and j denotes the imaginary part.

• max is 40 when the analysis mode is Line RMS and 35 when it is Power.

		(Table 2/2)
	Methods of Determination and Equation	
	Harmonic order of measurement function	
Harmonic voltage distortion factor Uhdf [%]	<u>U(k)</u> U(1) ⋅ 100	
Harmonic current distortion factor Ihdf [%]	<u>l(k)</u> - 100	
Harmonic active power distortion factor Phdf [%]	<u>Ρ(k)</u> ⋅ 100 Ρ(1)	
Note		

• k denotes a harmonic order.

Power Analysis Equations (Delta Math)

Computed results are determined by substituting all of the sampled data in the table into the equations for voltage U and current I.* The synchronization source used in delta computation is the same source as the source of the first source channel (the input element with the smallest number) in the wiring unit that is subject to delta computation.

	Delta Math Type φΣ [°]	Substituted Sa	mpled Data	Data Determined by Del Examples of Measurem	Notes	
	.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	u (t)	i (t)	and Symbols		
	3P3W→3V3A	u1– u2	– i1– i2	Unmeasured line current calculated in a three-phase three-wire system	Urms1, Umn1, Udc1, Uac1 Irms1, Imn1, Idc1, Iac1	Assumption i1+i2+i3=0
Function	Delta→Star	u1- <u>(u1+u2)</u> 3			Urms1, Umn1, Udc1, Uac1	Assumption Calculated on
		$u2 - \frac{(u1+u2)}{3}$		Phase voltage calculated in a three-phase t	Urms2, Umn2, Udc2, Uac2	that the center of the delta connection is the center of the star connection.
Delta		- <u>(u1+u2)</u> 3		nree-wire (3V3A) system	Urms3, Umn3, Udc3, Uac3	
			i1+i2+i3	Neutral line current	In	
	Star→Delta	Star→Delta u1–u2			Urms1, Umn1, Udc1, Uac1	
		u2–u3		Line voltage calculated in a three-phase four-wire system	Urms2, Umn2, Udc2, Uac2	
		u3–u1			Urms3, Umn3, Udc3, Uac3	
			i1+i2+i3	Neutral line current	In	

* Equations for voltage U and current I for "Power Analysis Equation (For Each Source Channel)"

Note.

u1, u2, and u3 represent the sampled voltage data of source channel 1, 2, and 3, respectively. i1, i2, and i3 represent the sampled current data of source channel 1, 2, and 3, respectively.

Power Math Measurement Functions Power Analysis (Power)

When the Analysis	s Mode is	1Wiring	System
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Channels/ Sub channels	Symbol	Math Item	Suppo	rted Wir	ing Syst	ems				
			1P2W	1P3W	3P3W	3P3W (3V3A)	3P4W	3P3W (3P3W->3V3A)	3V3A->3P4W (Delta->Start)	3P4W->3V3A (Start->Delta)
CH13_1	UrmsΣ	Rms voltage		Yes	Yes	Yes	Yes	Yes	Yes	Yes
 CH13_2	Urms1	Each rms voltage	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_3	Urms2	Each rms voltage		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_4	Urms3	Each rms voltage				Yes	Yes	Yes	Yes	Yes
CH13_5	lrmsΣ	Rms current		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_6	Irms1	Each rms current	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_7	Irms2	Each rms current		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_8	Irms3	Each rms current				Yes	Yes	Yes	Yes	Yes
CH13_9	UdcΣ	Voltage simple		Yes	Yes	Yes	Yes	Yes	Yes	Yes
01142 40		average (DC)	Vaa	Vee	Vee	Vee	Vaa	Vaa	Vaa	
CH13_10	Udc1	average (DC)	Yes	res	Yes	Yes	Yes	Yes	Yes	res
CH13_11	Udc2	Voltage simple average (DC)		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_12	Udc3	Voltage simple average (DC)				Yes	Yes	Yes	Yes	Yes
CH13_13	ldcΣ	Current simple average (DC)		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_14	ldc1	Current simple average (DC)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_15	ldc2	Current simple		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_16	ldc3	Current simple				Yes	Yes	Yes	Yes	Yes
CH13_17	UacΣ	Voltage AC		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_18	Uac1	Voltage AC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_19	Uac2	Voltage AC		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_20	Uac3	Voltage AC				Yes	Yes	Yes	Yes	Yes
CH13_21	lacΣ	Current AC		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_22	lac1	Current AC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_23	lac2	Current AC		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_24	lac3	Current AC				Yes	Yes	Yes	Yes	Yes
CH13 25	ΡΣ	Active power P		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13 26	P1	Active power P	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
 CH13_27	P2	Active power P		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_28	P3	Active power P				Yes	Yes	Yes	Yes	Yes
CH13_29	SΣ	Apparent power S		Yes	Yes	Yes	Yes	Yes	Yes	Yes
 CH13_30	S1	Apparent power S	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
 CH13_31	S2	Apparent power S		Yes	Yes	Yes	Yes	Yes	Yes	Yes
	S3	Apparent power S				Yes	Yes	Yes	Yes	Yes
CH13_33	QΣ	Reactive power Q		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_34	Q1	Reactive power Q	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_35	Q2	Reactive power Q		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_36	Q3	Reactive power Q				Yes	Yes	Yes	Yes	Yes

Channels/ Sub channels	Symbo	I Math Item	Suppo	rted Wir	ring Syst	tems				
			1P2W	1P3W	3P3W	3P3W (3V3A)	3P4W	3P3W (3P3W->3V3A)	3V3A->3P4W (Delta->Start)	3P4W->3V3A (Start->Delta)
CH13_37	λΣ	Power factor		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_38	λ1	Each power factor	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_39	λ2	Each power factor		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_40	λ3	Each power factor				Yes	Yes	Yes	Yes	Yes
CH13_41	ΦΣ	Phase angle		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_42	Φ1	Phase angle	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_43	Ф2	Phase angle		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_44	Ф3	Phase angle				Yes	Yes	Yes	Yes	Yes
CH13_45	fU1	Voltage frequency	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_46	fU2	Voltage frequency		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_47	fU3	Voltage frequency				Yes	Yes	Yes	Yes	Yes
CH13_48	fl1	Current frequency	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_49	fl2	Current frequency		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_50	fI3	Current frequency				Yes	Yes	Yes	Yes	Yes
CH13_51	U+pk1	Maximum voltage	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_52	U-pk1	Minimum voltage	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_53	U+pk2	Maximum voltage		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_54	U-pk2	Minimum voltage		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_55	U+pk3	Maximum voltage				Yes	Yes	Yes	Yes	Yes
CH13_56	U-pk3	Minimum voltage				Yes	Yes	Yes	Yes	Yes
CH13_57	l+pk1	Maximum current	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_58	I-pk1	Minimum current	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_59	l+pk2	Maximum current		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_60	I-pk2	Minimum current		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_61	I+pk3	Maximum current				Yes	Yes	Yes	Yes	Yes
CH13_62	I-pk3	Minimum current				Yes	Yes	Yes	Yes	Yes
CH13_63	P+pk1	Maximum power	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_64	P-pk1	Minimum power	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH14 1	P+pk2	Maximum power		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH14_2	P-pk2	Minimum power		Yes	Yes	Yes	Yes	Yes	Yes	Yes
 CH14_3	P+pk3	Maximum power				Yes	Yes	Yes	Yes	Yes
 CH14_4	P-pk3	Minimum power				Yes	Yes	Yes	Yes	Yes
CH14 5	WPΣ	Integrated power		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH14 6	WP1	Integrated power	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
 CH14_7	WP2	Integrated power	_	Yes	Yes	Yes	Yes	Yes	Yes	Yes
 CH14_8	WP3	Integrated power	_			Yes	Yes	Yes	Yes	Yes
CH14_9	WP+Σ	Integrated power		Yes	Yes	Yes	Yes	Yes	Yes	Yes
 CH14_10	WP+1	Integrated power	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH14 11	WP+2	Integrated power		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH14 12	WP+3	Integrated power				Yes	Yes	Yes	Yes	Yes
CH14 13	WP-Σ	Integrated power	_	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH14 14	WP-1	Integrated power	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
 CH14_15	WP-2	Integrated power	_	Yes	Yes	Yes	Yes	Yes	Yes	Yes
 CH14_16	WP-3	Integrated power				Yes	Yes	Yes	Yes	Yes
CH14 17	qΣ	Integrated ampere-	_	Yes	Yes	Yes	Yes	Yes	Yes	Yes
		hour								
CH14_18	q1	Integrated ampere-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
01144 40	~?	hour		Ver	Vee	Vee	Vee	Vaa	Vaa	Vaa
CH 14_19	qz	hour		res	res	res	res	tes	res	res
CH14_20	q3	Integrated ampere- hour				Yes	Yes	Yes	Yes	Yes

Channels/ Sub channels	Symbo	I Math Item	Suppo	orted Win	ring Syst	tems				
			1P2W	1P3W	3P3W	3P3W (3V3A)	3P4W	3P3W (3P3W->3V3A)	3V3A->3P4W (Delta->Start)	3P4W->3V3A (Start->Delta)
CH14_21	q+Σ	Integrated ampere- hour		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH14_22	q+1	Integrated ampere- hour	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH14_23	q+2	Integrated ampere- hour		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH14_24	q+3	Integrated ampere- hour				Yes	Yes	Yes	Yes	Yes
CH14_25	q-Σ	Integrated ampere- hour		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH14_26	q-1	Integrated ampere- hour	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH14_27	q-2	Integrated ampere- hour		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH14_28	q-3	Integrated ampere- hour				Yes	Yes	Yes	Yes	Yes
CH14_29	WSΣ	Volt-ampere hours		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH14_30	WS1	Volt-ampere hours WS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH14_31	WS2	Volt-ampere hours		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH14 32	WS3	Volt-ampere hours				Yes	Yes	Yes	Yes	Yes
	ΨΩΣ	Var hours		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH14_34	WO1	Var hours WO	Voc	Ves	Voc	Voc	Voc	Ves	Ves	Ves
<u>CU14_25</u>	WOO	Var hours	103	Vee	Vee	Vee	Vee	Vee	Vee	Vee
CH14_35	WQZ			165	Tes	165	ies			Tes
CH14_36	WQ3	Var hours				Yes	Yes	Yes	Yes	Yes
CH14_37	ΖΣ	Load circuit impedance		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH14_38	Z1	Load circuit impedance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH14_39	Z2	Load circuit impedance		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH14_40	Z3	Load circuit impedance				Yes	Yes	Yes	Yes	Yes
CH14_41	RSΣ	Load circuit series resistance		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH14_42	RS1	Load circuit series resistance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH14_43	RS2	Load circuit series resistance		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH14_44	RS3	Load circuit series resistance				Yes	Yes	Yes	Yes	Yes
CH14_45	ΧSΣ	Load circuit series reactance		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH14_46	XS1	Load circuit series reactance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH14_47	XS2	Load circuit series reactance		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH14_48	XS3	Load circuit series reactance				Yes	Yes	Yes	Yes	Yes
CH14_49	RPΣ	Load circuit parallel resistance		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH14_50	RP1	Load circuit parallel resistance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH14_51	RP2	Load circuit parallel resistance		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH14_52	RP3	Load circuit parallel resistance				Yes	Yes	Yes	Yes	Yes
CH14_53	ΧΡΣ	Load circuit parallel reactance		Yes	Yes	Yes	Yes	Yes	Yes	Yes

Channels/	Symbol	Math Item	Supported Wiring Systems											
Sub channels														
			1P2W	1P3W	3P3W	3P3W (3V3A)	3P4W	3P3W (3P3W->3V3A)	3V3A->3P4W (Delta->Start)	3P4W->3V3A (Start->Delta)				
CH14_54	XP1	Load circuit parallel reactance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes				
CH14_55	XP2	Load circuit parallel reactance		Yes	Yes	Yes	Yes	Yes	Yes	Yes				
CH14_56	XP3	Load circuit parallel reactance	_			Yes	Yes	Yes	Yes	Yes				
CH14_57	Pm	Motor output (drive efficiency)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes				
CH14_58	η	Efficiency	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes				
CH14_59	Uubf	Three-phase voltage unbalance factor				Yes	Yes	Yes	Yes	Yes				
CH14_60	lubf	Three-phase current unbalance factor				Yes	Yes	Yes	Yes	Yes				
CH14_61	In	Neutral line current				Yes	Yes	Yes	Yes	Yes				
CH14_62	Time	Integration time	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes				

Channels/Sub	channels	Symbol	Math Item	Suppo	rted Wi	ring Sys	stems				
Wiring System1	Wiring System2			1P2W	1P3W	3P3W	3P3W (3V3A)	3P4W	3P3W (3P3W- >3V3A)	3V3A (Delta->Start)	3P4W (Start->Delta)
CH13_1	CH14_1	UrmsΣ	Rms voltage		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_1	CH14_1	Urms1	Each rms voltage	Yes							
CH13_2	CH14_2	lrmsΣ	Rms current		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_2	CH14_2	lrms1	Each rms current	Yes							
CH13_3	CH14_3	UdcΣ	Voltage simple average (DC)		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_3	CH14_3	Udc1	Voltage simple average (DC)	Yes							
CH13_4	CH14_4	ldcΣ	Current simple average (DC)		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_4	CH14_4	ldc1	Current simple average (DC)	Yes							
CH13_5	CH14_5	UacΣ	Voltage AC		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_5	CH14_5	Uac1	Voltage AC	Yes							
CH13_6	CH14_6	lacΣ	Current AC		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_6	CH14_6	lac1	Current AC	Yes							
CH13 7	CH14 7	ΡΣ	Active power P		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_7	CH14_7	P1	Active power P	Yes	100	100	100	100	100	100	100
CH13_8	CH14_8	SΣ	Apparent power S	100	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_8	CH14_8	S1	Apparent power S	Yes							
CH13 9	CH14 9	ο	Reactive power Q	100	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13 9	CH14 9	Q1	Reactive power Q	Yes							
CH13 10	CH14 10	λΣ	Power factor		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13 10	CH14 10	λ1	Each power factor	Yes							
CH13 11	CH14 11	ΦΣ	Phase angle		Yes	Yes	Yes	Yes	Yes	Yes	Yes
 CH13_11	CH14_11	Φ1	Phase angle	Yes		-	-				
CH13 12	CH14 12	fU1	Voltage frequency	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
 CH13_13	 CH14_13	fU2	Voltage frequency		Yes	Yes	Yes	Yes	Yes	Yes	Yes
 CH13_14	 CH14_14	fU3	Voltage frequency				Yes	Yes	Yes	Yes	Yes
CH13_15	CH14_15	fl1	Current frequency	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_16	CH14_16	fl2	Current frequency		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_17	CH14_17	fl3	Current frequency				Yes	Yes	Yes	Yes	Yes
CH13_18	CH14_18	U+pk1	Maximum voltage	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_19	CH14_19	U-pk1	Minimum voltage	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_20	CH14_20	U+pk2	Maximum voltage		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_21	CH14_21	U-pk2	Minimum voltage	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_22	CH14_22	U+pk3	Maximum voltage				Yes	Yes	Yes	Yes	Yes
CH13_23	CH14_23	U-pk3	Minimum voltage				Yes	Yes	Yes	Yes	Yes
CH13_24	CH14_24	l+pk1	Maximum current	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_25	CH14_25	l-pk1	Minimum current	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_26	CH14_26	l+pk2	Maximum current		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_27	CH14_27	I-pk2	Minimum current		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_28	CH14_28	l+pk3	Maximum current				Yes	Yes	Yes	Yes	Yes
CH13_29	CH14_29	l-pk3	Minimum current				Yes	Yes	Yes	Yes	Yes
CH13_30	CH14_30	P+pk1	Maximum power	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_31	CH14_31	P-pk1	Minimum power	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_32	CH14_32	P+pk2	Maximum power		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_33	CH14_33	P-pk2	Minimum power		Yes	Yes	Yes	Yes	Yes	Yes	Yes

When the Analysis Mode is 2Wiring Systems

Channels/Sub	channels	Symbol	Math Item	Suppo	rted Wi	ring Sys	stems				
Wiring System1	Wiring System2			1P2W	1P3W	3P3W	3P3W (3V3A)	3P4W	3P3W (3P3W- >3V3A)	3V3A (Delta->Start)	3P4W (Start->Delta)
CH13_34	CH14_34	P+pk3	Maximum power				Yes	Yes	Yes	Yes	Yes
CH13_35	CH14_35	P-pk3	Minimum power				Yes	Yes	Yes	Yes	Yes
CH13_36	CH14_36	WPΣ	Integrated power		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_36	CH14_36	WP1	Integrated power	Yes					_		
CH13_37	CH14_37	WP+Σ	Integrated power		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_37	CH14_37	WP+1	Integrated power	Yes							
CH13_38	CH14_38	WP-Σ	Integrated power		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_38	CH14_38	WP-1	Integrated power	Yes							
CH13_39	CH14_39	qΣ	Integrated ampere- hour		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_39	CH14_39	q1	Integrated ampere- hour	Yes							
CH13_40	CH14_40	q+Σ	Integrated ampere- hour		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_40	CH14_40	q+1	Integrated ampere- hour	Yes							
CH13_41	CH14_41	q-Σ	Integrated ampere- hour		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_41	CH14_41	q-1	Integrated ampere- hour	Yes							
CH13_42	CH14_42	WSΣ	Volt-ampere hours		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_42	CH14_42	WS1	Volt-ampere hours WS	Yes							
CH13_43	CH14_43	WQΣ	Var hours		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_43	CH14_43	WQ1	Var hours WQ	Yes							
CH13_44	CH14_44	ΖΣ	Load circuit impedance		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_44	CH14_44	Z1	Load circuit impedance	Yes							
CH13_45	CH14_45	RSΣ	Load circuit series resistance		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_45	CH14_45	RS1	Load circuit series resistance	Yes							
CH13_46	CH14_46	ΧSΣ	Load circuit series reactance		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_46	CH14_46	XS1	Load circuit series reactance	Yes							
CH13_47	CH14_47	RPΣ	Load circuit parallel resistance		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_47	CH14_47	RP1	Load circuit parallel resistance	Yes							
CH13_48	CH14_48	ΧΡΣ	Load circuit parallel reactance		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_48	CH14_48	XP1	Load circuit parallel reactance	Yes							
CH13_49	CH14_49	Pm	Motor output (drive efficiency)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_50	CH14_50	η	Efficiency	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH13_51	CH14_51	Uubf	Three-phase voltage unbalance factor				Yes	Yes	Yes	Yes	Yes
CH13_52	CH14_52	lubf	Three-phase current unbalance factor				Yes	Yes	Yes	Yes	Yes
CH13_53	CH14_53	In	Neutral line current				Yes	Yes	Yes	Yes	Yes
CH13_54	CH14_54	Time	Integration time	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Harmonic Analysis (Harmonics)

When the analysis mode is Line RMS

Channels/Sub channels	Symbol	Math Item
CH15_1 to CH15_40	RMS	Rms value (1st to 40th harmonic)
CH15_41 to CH15_64 CH16_1 to CH16_16	Rhdf(harmonic distortion factor)	Percentage content (1st to 40th harmonic)
CH16_17 to CH16_56	Φ	Phase angle (1st to 40th harmonic)
CH16_57	RMS	Total rms value
CH16_58	THD (IEC)	Distortion factor (IEC)
CH16_59	THD (CSA)	Distortion factor (CSA)

When the Analysis Mode is Power

Channels/ Symbol Math Item Supported Wiring Systems										
Sub channels			1P2W	1 P3W	3P3W	3P3W (3V3A)	3P4W	3P3W (3P3W- >3V3A)	3V3A (Delta->Start)	3P4W (Start->Delta)
CH15_1 to CH15_35 CH15_36 to CH16_6 CH16_7 to CH16_41	Ρ	Active power (1st to 35th harmonic)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH15_41 to CH15_64 CH16_1 to CH16_16	Phdf(harmonic distortion factor)	Active power percentage content (1st to 35th harmonic)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH16_7 to CH16_41	Φ	Phase angle (1st to 35th harmonic)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH16_42	Р	Total active powers	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH16_43	S	Total apparent powers	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH16_44	Q	Total reactive powers	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH16_45	λ	Power factor	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH16_46	U1rms	1st harmonic rms voltage	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH16_47	l1rms	1st harmonic rms current	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH16_48	U2rms	1st harmonic rms voltage		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH16_49	I2rms	1st harmonic rms current		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH16_50	U3rms	1st harmonic rms voltage				Yes	Yes	Yes	Yes	Yes
CH16_51	l3rms	1st harmonic rms current				Yes	Yes	Yes	Yes	Yes
CH16_52	ΦU1-U1	1st harmonic voltage phase angle	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH16_53	ΦU1-I1	1st harmonic current phase angle	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH16_54	ΦU1-U2	1st harmonic voltage phase angle		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH16_55	ΦU1-I2	1st harmonic current phase angle		Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH16_56	ΦU1-U3	1st harmonic voltage phase angle				Yes	Yes	Yes	Yes	Yes
CH16_57	ΦU1-I3	1st harmonic current phase angle				Yes	Yes	Yes	Yes	Yes

Appendix 3 Power Basics (Power, harmonics, and AC RLC circuits)

This section explains the basics of power, harmonics, and AC RLC circuits.

Power

Electrical energy can be converted into other forms of energy and used. For example, it can be converted into the heat in an electric heater, the torque in a motor, or the light in a fluorescent or mercury lamp. In these kinds of examples, the work that electricity performs in a given period of time (or the electrical energy expended) is referred to as electric power. The unit of electric power is watts (W). 1 watt is equivalent to 1 joule of work performed in 1 second.

DC Power

The DC power P (in watts) is determined by multiplying the applied voltage U (in volts) by the current I (in amps).

P = UI [W]

In the example below, the amount of electrical energy determined by the equation above is retrieved from the power supply and consumed by resistance R (in ohms) every second.



Alternating Current

Normally, the power supplied by power companies is alternating current with sinusoidal waveforms. The magnitude of alternating current can be expressed using values such as instantaneous, maximum, rms, and mean values. Normally, it is expressed using rms values.

The instantaneous value i of a sinusoidal alternating current is expressed by Imsin ω t (where Im is the maximum value of the current, ω is the angular velocity defined as $\omega = 2\pi f$, and f is the frequency of the sinusoidal alternating current). The thermal action of this alternating current is proportional to i², and varies as shown in the figure below.^{*}

⁷ Thermal action is the phenomenon in which electric energy is converted to heat energy when a current flows through a resistance.



The rms value (effective value) is the DC value that generates the same thermal action as the alternating current. With I as the DC value that produces the same thermal action as the alternating current:

I=
$$\sqrt{\text{The mean of } i^2 \text{ over one period}} = \sqrt{\frac{1}{2\pi} \int_0^{2\pi} i^2 d\omega t} = \frac{\text{Im}}{\sqrt{2}}$$

Because this value corresponds to the root mean square of the instantaneous values over 1 period, the effective value is normally denoted using the abbreviation "rms."

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To determine the mean value, the average is taken over 1 period of absolute values, because simply taking the average over 1 period of the sine wave results in a value of zero. With Imn as the mean value of the instantaneous current i (which is equal to $Imsin\omega t$):

Imp = The mean of
$$|i|$$
 over one period = $\frac{1}{2\pi} \int_{0}^{2\pi} |i| d\omega t = \frac{2}{\pi} Im$

These relationships also apply to sinusoidal voltages.

The maximum value, rms value, and mean value of a sinusoidal alternating current are related as shown below. The crest factor and form factor are used to define the tendency of an AC waveform.

Crest factor = $\frac{\text{Maximum value}}{\text{Rms value}}$ Form factor = $\frac{\text{Rms value}}{\text{Mean value}}$

Vector Display of Alternating Current

In general, instantaneous voltage and current values are expressed using the equations listed below.

Voltage: u = Umsinwt

Current: i = Imsin($\omega t - \Phi$)

The time offset between the voltage and current is called the phase difference, and Φ is the phase angle. The time offset is mainly caused by the load that the power is supplied to. In general, the phase difference is zero when the load is purely resistive. The current lags the voltage when the load is inductive (is coiled). The current leads the voltage when the load is capacitive.



A vector display is used to clearly convey the magnitude and phase relationships between the voltage and current. A positive phase angle is represented by a counterclockwise angle with respect to the vertical axis.

Normally, a dot is placed above the symbol representing a quantity to explicitly indicate that it is a vector. The magnitude of a vector represents the rms value.

When the current lags the voltage When the current leads the voltage



Three-Phase AC Wiring

Generally three-phase AC power lines are connected in star wiring configurations or delta wiring configurations.



Vector Display of Three-Phase Alternating Current

In typical three-phase AC power, the voltage of each phase is offset by 120°. The figure below expresses this offset using vectors. The voltage of each phase is called the phase voltage, and the voltage between each phase is called the line voltage.



If a power supply or load is connected in a delta wiring configuration and no neutral line is present, the phase voltage cannot be measured. In this case, the line voltage is measured. Sometimes the line voltage is also measured when measuring three-phase AC power using two single-phase wattmeters (the two-wattmeter method). If the magnitude of each phase voltage is equal and each phase is offset by 120°, the magnitude of the line voltage is $\sqrt{3}$ times the magnitude of the phase voltage, and the line voltage phase is offset by 30°.

Below is a vector representation of the relationship between the phase voltages and line currents of a three-phase AC voltage when the current lags the voltage by Φ° .



AC Power

AC power cannot be determined as easily as DC power, because of the phase difference between the voltage and current caused by load.

If the instantaneous voltage $u = U_m \sin \omega t$ and the instantaneous current $i = Im \sin(\omega t - \Phi)$, the instantaneous AC power p is as follows:

 $p = u \times i = U_m sin\omega t \times I_m sin(\omega t - \Phi) = U lcos \Phi - U lcos(2\omega t - \Phi)$

U and I represent the rms voltage and rms current, respectively.

p is the sum of the time-independent term, UIcos Φ , and the AC component term of the voltage or current at twice the frequency, $-UIcos(2\omega t - \Phi)$.

AC power refers to the mean power over 1 period. When the mean over 1 period is taken, AC power P is as follows:

P = UIcosΦ [W]

Even if the voltage and current are the same, the power varies depending on the phase difference Φ . The section above the horizontal axis in the figure below represents positive power (power supplied to the load), and the section below the horizontal axis represents negative power (power fed back from the load). The difference between the positive and negative powers is the power consumed by the load. As the phase difference between the voltage and current increases, the negative power increases. At $\Phi = \pi/2$, the positive and negative powers are equal, and the load consumes no power.





When the phase difference between voltage and current is Φ



When phase difference between voltage and current is $\frac{\pi}{2}$



The positive and negative powers are the same
Active Power and the Power Factor

In alternating electrical current, not all of the power calculated by the product of voltage and current, UI, is consumed. The product of U and I is called the apparent power. It is expressed as S. The unit of apparent power is the volt-ampere (VA). The apparent power is used to express the electrical capacity of a device that runs on AC electricity.

The true power that a device consumes is called active power (or effective power). It is expressed as P. This power corresponds to the AC power discussed in the previous section.

S = UI [VA]

P = UlcosΦ [W]

 $cos\Phi$ is called the power factor and is expressed as λ . It indicates the portion of the apparent power that becomes true power.

Reactive Power

If current I lags voltage U by Φ , current I can be broken down into a component in the same direction as voltage U, Icos Φ , and a perpendicular component, Isin Φ . Active power P, which is equal to UIcos Φ , is the product of voltage U and the current component Icos Φ . The product of voltage U and the current component Isin Φ is called the reactive power. It is expressed as Q. The unit of reactive power is the var.

Q = UlsinΦ [var]



The relationship between S, the apparent power, P, the active power, and Q, the reactive power is as follows:

 $S^2 = P^2 + Q^2$

Harmonics

Harmonics refer to all sine waves whose frequency is an integer multiple of the fundamental wave (normally a 50 Hz or 60 Hz sinusoidal power line signal) except for the fundamental wave itself. The input currents that flow through the power rectification circuits, phase control circuits, and other circuits used in various kinds of electrical equipment generate harmonic currents and voltages in power lines. When the fundamental wave and harmonic waves are combined, waveforms become distorted, and interference sometimes occurs in equipment connected to the power line.

Terminology

The terminology related to harmonics is described below.

• Fundamental wave (fundamental component)

The sine wave with the longest period among the different sine waves contained in a periodic complex wave. Or the sine wave that has the fundamental frequency within the components of the complex wave.

Fundamental frequency

The frequency corresponding to the longest period in a periodic complex wave. The frequency of the fundamental wave.

- Distorted wave A wave that differs from the fundamental wave.
- Higher harmonic
 A sine wave with a frequency that is an integer multiple (twice or more) of the fundamental frequency.
- Harmonic component

A waveform component with a frequency that is an integer multiple (twice or more) of the fundamental frequency.

· Harmonic distortion factor

The ratio of the rms value of the specified nth order harmonic contained in the distorted wave to the rms value of the fundamental wave (or all signals).

Harmonic order

The integer ratio of the harmonic frequency with respect to the fundamental frequency.

 Total harmonic distortion The ratio of the rms value of all harmonics to the rms value of the fundamental wave (or all signals).

Some of the effects of harmonics on electrical devices and equipment are explained in the list below.

- Synchronization capacitors and series reactors Harmonic current reduces circuit impedance. This causes excessive current flow, which can result in vibration, humming, overheat, or burnout.
- Cables

Harmonic current flow through the neutral line of a three-phase, four-wire system will cause the neutral line to overheat.

- Voltage transformers Harmonics cause magnetostrictive noise in the iron core and increase iron and copper loss.
- Breakers and fuses
 Excessive harmonic current can cause erroneous operation and blow fuses.
- Communication lines
 The electromagnetic induction caused by harmonics creates noise voltage.
- Controllers
 Harmonic distortion of control signals can lead to erroneous operation.
- Audio visual equipment

Harmonics can cause degradation of performance and service life, noise-related video flickering, and damaged parts.

AC RLC Circuits

Resistance

The current i when an AC voltage whose instantaneous value $u = U_m sin\omega t$ is applied to load resistance R [Ω] is expressed by the equation below. I_m denotes the maximum current.

$$i = \frac{U_m}{R} \sin \omega t = I_m \sin \omega t$$

Expressed using rms values, the equation is I = U/R.

There is no phase difference between the current flowing through a resistive circuit and the voltage.



Inductance

The current i when an AC voltage whose instantaneous value $u = U_m \sin\omega t$ is applied to a coil load of inductance L [H] is expressed by the equation below.

$$i = \frac{U_m}{X_L} sin\left(\omega t - \frac{\pi}{2}\right) = I_m sin\left(\omega t - \frac{\pi}{2}\right)$$

Expressed using rms values, the equation is $I = U/X_L$. X_L is called inductive reactance and is defined as $X_L = \omega_L$. The unit of inductive reactance is Ω .

Inductance works to counter current changes (increase or decrease), and causes the current to lag the voltage.



Capacitance

The current i when an AC voltage whose instantaneous value $u = U_m \sin\omega t$ is applied to a capacitive load C [F] is expressed by the equation below.

$$i = \frac{U_m}{X_c} sin\left(\omega t + \frac{\pi}{2}\right) = I_m sin\left(\omega t + \frac{\pi}{2}\right)$$

Expressed using rms values, the equation is I = U/X_C. X_C is called capacitive reactance and is defined as $X_C = 1/\omega C$. The unit of capacitive reactance is Ω .

When the polarity of the voltage changes, the largest charging current with the same polarity as the voltage flows through the capacitor. When the voltage decreases, discharge current with the opposite polarity of the voltage flows. Thus, the current phase leads the voltage.



Series RLC Circuits

The equations below express the voltage relationships when resistance $R_S [\Omega]$, inductance L [H], and capacitance C [F] are connected in series.

$$U = \sqrt{(U_{Rs})^{2} + (U_{L} - U_{C})^{2}} = \sqrt{(IRs)^{2} + (IX_{L} - IX_{C})^{2}}$$

$$= I\sqrt{(Rs)^{2} + (X_{L} - X_{C})^{2}} = I\sqrt{RS^{2} + XS^{2}}$$

$$I = \frac{U}{\sqrt{Rs^{2} + Xs^{2}}}, \quad \Phi = \tan^{-1}\frac{Xs}{Rs}$$

$$\underbrace{\bigcup_{L} \qquad \bigcup_{L} \qquad \bigcup_{L} \qquad \bigcup_{L} \qquad \bigcup_{L} \qquad \bigcup_{L} \qquad \bigoplus_{L} \ \bigoplus_{L} \qquad \bigoplus_{L} \ \bigoplus_{L} \qquad \bigoplus_{L} \ \bigoplus_{L$$

The relationship between resistance R_S , reactance X_S , and impedance Z is expressed by the equations below.

$$X_{\rm S} = X_{\rm L} - X_{\rm C}$$
$$Z = \sqrt{R_{\rm S}^2 + X_{\rm S}^2}$$

Parallel RLC Circuits

The equations below express the current relationships when resistance $R_P[\Omega]$, inductance L [H], and capacitance C [F] are connected in parallel.

The relationship between resistance R_P , reactance X_P , and impedance Z is expressed by the equations below.

$$X_{P} = \frac{X_{L}X_{C}}{X_{C} - X_{L}}$$
$$Z = \frac{R_{P}X_{P}}{\sqrt{R_{P}^{2} + X_{P}^{2}}}$$

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