TRION sub-modules

TRION sub-modules

In combination with the *TRION(3)-18xx-POWER-4*, *TRION-1810-HV-8* and *TRION3-1810-SUB-8* boards, the interchangable TRION sub-modules can be used to create individual input configurations.

TRION sub-modules overview

The following sections provide an overview and detailed information on the TRION sub-modules. The values given below were determined in a standardized test setting[1].

Type	Range	Bandwidth	Isolated
TRION-SUB-600V	600 V_{RMS} (±1500 V_{PEAK})	300 kHz	Yes
TRION-SUB-5V	5 V_{RMS} (±10 V_{PEAK})	300 kHz	Yes
TRION-POWER-SUB-CUR-20A-1B	20 A_{RMS} (±40 A_{PEAK})	300 kHz	Yes
TRION-POWER-SUB-CUR-2A-1B	2 A_{RMS} (±4 A_{PEAK})	300 kHz	Yes
TRION-POWER-SUB-CUR-1A-1B	1 A_{RMS} (±2 A_{PEAK})	300 kHz	Yes
TRION-POWER-SUB-CUR-02A-1B	0.2 A_{RMS} (±0.4 A_{PEAK})	300 kHz	Yes
TRION-POWER-SUB-dLV-5V	5 V_{RMS} (±10 V_{PEAK})	5 MHz	No
TRION-POWER-SUB-dLV-1V	1 V_{RMS} (±2 V_{PEAK})	5 MHz	No
TRION-POWER-SUB-dLV-1	5 V_{RMS} (±10 V_{PEAK})	150 kHz	No

Tab. 82: TRION sub-modules overview

1) The following accuracy conditions were applied: Temperature: 23 ±5 °C; humidity: 40 to 60 % rel. humidity; input waveform: sine wave; common mode voltage: 0 V; line filter: Auto; sample rate: 1 MS/s; resolution: 24 bit; power factor: 1; after warm-up; after zero level, accuracy: Frequency (f) in [kHz] (12-month accuracy ± reading error and range error)

2) Not supported by TRION3-18xx-SUB-8 module.

DEWETRON

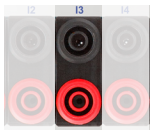
TRION-SUB-600V

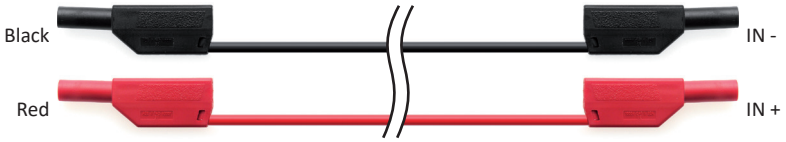
TRION-SUB-600V				
Input range	600 V_{RMS} (±1500 V_{PEAK}) CF=2.5			
Resolution	20 bit			
Accuracy	DC	±0.02 % of reading ±0.005 % of range		
	0.5 Hz to 10 kHz	±0.03 % of reading		
	10 kHz to 100 kHz	±(0.015 % * f) of reading	f: frequency in kHz	
	100 kHz to 200 kHz	±(0.04 % * f) of reading	f: frequency in kHz	
Gain drift	20 ppm / °C			
Offset drift	1 mV / °C			
Typical THD	-105 dB			
Typical CMRR	>100 dB @ 50 Hz; >90 dB @ 1 kHz; >70 dB @ 10 kHz; >50 dB @ 100 kHz			
Bandwidth (-3 dB)	300 kHz			
Rated input voltage to earth according to EN 61010-2-30	300 V CAT III / 600 V CAT II			
Isolation voltage	3750 V_{RMS} (1 min); 35 kV/µs transient immunity			
Common mode voltage	600 V_{RMS}			
Overvoltage protection	1500 V_{PEAK} or 1000 V_{RMS} (1 min)			
Input impedance	5 MΩ; 3.5 pF			
Isolation (earth) resistance	100 GΩ; 4 pF (IN- to GND)			
Connector	Safety banana sockets			
	SNR	SFDR[1)]	ENOB[2)]	$Noise_{PP}$
Sample rate	[dB]	[dB]	[Bit]	[mV]
0.1 kS/s	125	140	20.4	2.0
1 kS/s	120	140	19.6	3.2
10 kS/s	111	140	18.2	5.4
100 kS/s	104	140	16.9	35.0
1000 kS/s	93	128	15.1	150.0
2000 kS/s	93	126	15.1	151.0

Tab. 83: TRION-SUB-600V

1) SFDR excluding harmonics

2) ENOB calculated from SNR





WARNING

Risk of injury due to electric shock

Voltage measurement on lines above 33 V_{RMS}, 46.7 V_{PEAK} or 70 V_{DC} is only permitted with rated safety test leads.

DEWETRON

TRION-SUB-5V

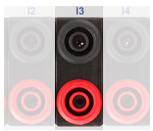
TRION-SUB-5V				
Input range	5 V_{RMS} (±10 V_{PEAK}) CF=2			
Resolution	20 bit			
Accuracy	DC	±0.02 % of reading ±0.005 % of range		
	0.5 Hz to 10 kHz	±0.03 % of reading		
	10 kHz to 100 kHz	±(0.015 % * f) of reading	f: frequency in kHz	
	100 kHz to 200 kHz	±(0.04 % * f) of reading	f: frequency in kHz	
Gain drift	20 ppm / °C			
Offset drift	1 µV / °C			
Typical THD	-102 dB			
Typical CMRR	>140 dB @ 50 Hz; >106 dB @ 10 kHz; >102 dB @ 100 kHz			
Bandwidth (-3 dB)	300 kHz			
Rated input voltage to earth according to EN 61010-2-30	300 V CAT III / 600 V CAT II			
Isolation voltage	3750 V_{RMS} (1 min); 35 kV/µs transient immunity			
Common mode voltage	600 V_{RMS}			
Overvoltage protection	1000 V_{PEAK} or 600 V_{RMS} (1 min)			
Input impedance	5 MΩ; 22 pF			
Isolation (earth) resistance	100 GΩ; 4 pF (IN- to GND)			
Connector	Safety banana sockets			

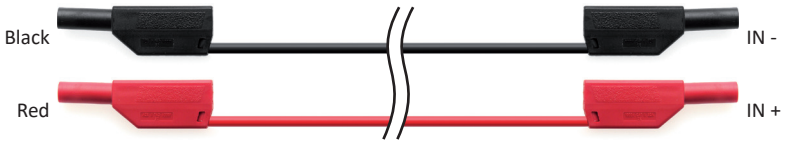
Sample rate	SNR [dB]	SFDR[1] [dB]	ENOB[2] [Bit]	$Noise_{PP}$ [µV]
0.1 kS/s	134	145	22.0	5
1 kS/s	126	148	20.6	14
10 kS/s	118	145	19.4	44
100 kS/s	109	138	17.8	155
1000 kS/s	98	135	16.1	596
2000 kS/s	98	132	16.1	598

Tab. 84: TRION-SUB-5V

1) SFDR excluding harmonics

2) ENOB calculated from SNR





WARNING

Risk of injury due to electric shock

Voltage measurement on lines above 33 V_{RMS}, 46.7 V_{PEAK} or 70 V_{DC} is only permitted with rated safety test leads.

TRION-POWER-SUB-CUR-20A-1B

TRION-POWER-SUB-CUR-20A-1B			
Range	20 A_{RMS} (±40 A_{PEAK})		
Resolution	20 bit		
Accuracy[1)2)]	DC	±0.02 % of reading ±0.02 % of range[3)]	
	0.5 Hz to 1 kHz	±0.03 % of reading	
	1 kHz to 5 kHz	±0.15 % of reading	
	5 kHz to 10 kHz	±0.35 % of reading	
	10 kHz to 50 kHz	±(0.3 % + 0.05 % * f) of reading	f: frequency in kHz
	50 kHz to 300 kHz	±(0.10 % * f) of reading	f: frequency in kHz
Rated input voltage to earth according to EN 61010-2-30	600 V CAT II		
Isolation voltage	3750 V_{RMS} (1 min), 35 kV/µs transient immunity		
Bandwidth	300 kHz		
Connector	Safety banana plugs		
Overcurrent protection	50 A_{PEAK} or 40 A_{RMS} (1 s)		
Thermal current limit	20 A_{RMS}		
Input resistance	2 mΩ		

Typical signal to noise ratio, spurious free SNR, effective number of bits[4)]

	SNR	SFDR[5)]	ENOB[6)]	$Noise_{PP}$
Sample rate	[dB]	[dB]	[Bit]	[mA]
0.1 kS/s	101	117	16.5	0.8
1 kS/s	100	119	16.3	1.4
10 kS/s	98	113	16.0	2.1
100 kS/s	93	110	15.2	3.9
1000 kS/s	85	110	13.8	10.3
2000 kS/s	84	107	13.7	10.9

Tab. 85: TRION-POWER-SUB-CUR-20A-1B

1) For self-generated heat caused by current input, add 0.00015 × I^2 % of reading + 20 × I^2 µA to the current accuracy. 'I' is the current reading [A]. The influence from self-generated heat continues until the temperature of the shunt resistor inside the DEWE2-Chassis lowers even if the current input changes to a small value.

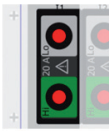
2) Below 1 % of range, add 10 ppm of range

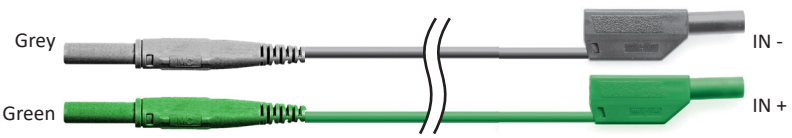
3) Add 0.03 % of range with no zero level.

4) LP filter in auto mode

5) SFDR excluding harmonics

6) ENOB calculated from SNR





WARNING

Risk of injury due to electric shock

Current measurement on lines above 33 V_{RMS}, 46.7 V_{PEAK} or 70 V_{DC} is only permitted with rated safety test leads.

DEWETRON

TRION-POWER-SUB-CUR-2A-1B

TRION-POWER-SUB-CUR-2A-1B			
Range	2 A_{RMS} (±4 A_{PEAK})		
Resolution	20 bit		
Accuracy[1]	DC	±0.02 % of reading ±0.02 % of range[2]	
	0.5 Hz to 10 kHz	±0.03 % of reading	
	10 kHz to 30 kHz	±0.1 % of reading	
	30 kHz to 200 kHz	±(0.015 % * f) of reading	f: frequency in kHz
	200 kHz to 300 kHz	±(0.1 % * f) of reading	f: frequency in kHz
Rated input voltage to earth according to EN 61010-2-30	600 V CAT II		
Isolation voltage	3750 V_{RMS} (1 min), 35 kV/µs transient immunity		
Bandwidth	300 kHz		
Connector	Safety banana plugs		
Overcurrent protection	10 A_{PEAK} or 5 A_{RMS} (1 s)		
Thermal current limit	3 A_{RMS}		
Input resistance	50 mΩ		

Typical signal to noise ratio, spurious free SNR, effective number of bits[3]

Sample rate	SNR [dB]	SFDR[4] [dB]	ENOB[5] [Bit]	$Noise_{PP}$ [µA]
0.1 kS/s	110	125	18.0	34.8
1 kS/s	107	126	17.5	47.2
10 kS/s	105	122	17.1	78.2
100 kS/s	100	120	16.3	172.6
1000 kS/s	91	114	14.8	541.2
2000 kS/s	90	114	14.7	553.1

Tab. 86: TRION-POWER-SUB-CUR-2A-1B

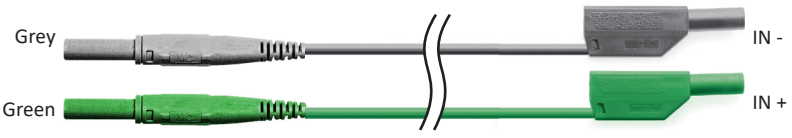
1) Below 1 % of range, add 25 ppm of range

2) Add 0.03 % of range with no zero level.

3) LP filter in auto mode

4) SFDR excluding harmonics

5) ENOB calculated from SNR



WARNING

Risk of injury due to electric shock

Current measurement on lines above 33 V_{RMS}, 46.7 V_{PEAK} or 70 V_{DC} is only permitted with rated safety test leads.

TRION-POWER-SUB-CUR-1A-1B

TRION-POWER-SUB-CUR-1A-1B			
Range	1 A_{RMS} (±2 A_{PEAK})		
Resolution	20 bit		
Accuracy[1]	DC	±0.02 % of reading ±80 µA[2]	
	0.5 Hz to 10 kHz	±0.03 % of reading	
	10 kHz to 30 kHz	±0.1 % of reading	
	30 kHz to 200 kHz	±(0.015 % * f) of reading	f: frequency in kHz
	200 kHz to 300 kHz	±(0.1 % * f) of reading	f: frequency in kHz
Rated input voltage to earth according to EN 61010-2-30	600 V CAT II		
Isolation voltage	3750 V_{RMS} (1 min), 35 kV/µs transient immunity		
Bandwidth	300 kHz		
Connector	Safety banana plugs		
Overcurrent protection	4 A_{PEAK} or 2 A_{RMS} (1 s)		
Thermal current limit	1 A_{RMS}		
Input resistance	500 mΩ		

Typical signal to noise ratio, spurious free SNR, effective number of bits[3]

Sample rate	SNR [dB]	SFDR[4] [dB]	ENOB[5] [Bit]	$Noise_{PP}$ [µA]
0.1 kS/s	131	149	21.5	1.4
1 kS/s	125	149	20.5	3.9
10 kS/s	116	144	19.0	12.6
100 kS/s	106	137	17.3	47.0
1000 kS/s	96	134	15.7	161.0
2000 kS/s	95	130	15.5	162.0

Tab. 87: TRION-POWER-SUB-CUR-1A-1B

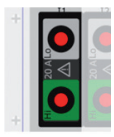
1) Below 1 % of range, add 25 ppm of range

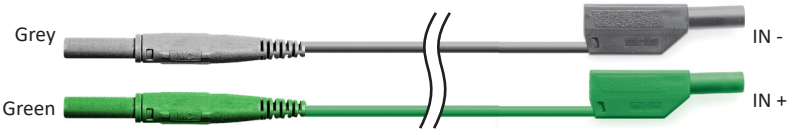
2) Add 0.03 % of range with no zero level.

3) LP filter in auto mode

4) SFDR excluding harmonics

5) ENOB calculated from SNR





WARNING

Risk of injury due to electric shock

Current measurement on lines above 33 V_{RMS}, 46.7 V_{PEAK} or 70 V_{DC} is only permitted with rated safety test leads.

DEWETRON

TRION-POWER-SUB-CUR-02A-1B

TRION-POWER-SUB-CUR-02A-1B			
Range	0.2 A_{RMS} (±0.4 A_{PEAK})		
Resolution	20 bit		
Accuracy[1]	DC	±0.02 % of reading ±0.02 % of range[2]	
	0.5 Hz to 10 kHz	±0.03 % of reading	
	10 kHz to 30 kHz	±0.1 % of reading	
	30 kHz to 200 kHz	±(0.015 % * f) of reading	f: frequency in kHz
	200 kHz to 300 kHz	±(0.1 % * f) of reading	f: frequency in kHz
Rated input voltage to earth according to EN 61010-2-30	600 V CAT II		
Isolation voltage	3750 V_{RMS} (1 min), 35 kV/µs transient immunity		
Bandwidth	300 kHz		
Connector	Safety banana plugs		
Overcurrent protection	2 A_{PEAK} or 1 A_{RMS} (1 s)		
Thermal current limit	0.5 A_{RMS}		
Input resistance	500 mΩ		

Typical signal to noise ratio, spurious free SNR, effective number of bits[3]

Sample rate	SNR [dB]	SFDR[4] [dB]	ENOB[5] [Bit]	$Noise_{PP}$ [µA]
0.1 kS/s	108	128	17.6	3.6
1 kS/s	107	123	17.5	5.6
10 kS/s	104	121	17.0	9.2
100 kS/s	99	114	16.2	17.3
1000 kS/s	91	114	14.8	51.3
2000 kS/s	90	114	14.7	54.9

Tab. 88: TRION-POWER-SUB-CUR-02A-1B

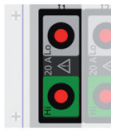
1) Below 1 % of range, add 25 ppm of range

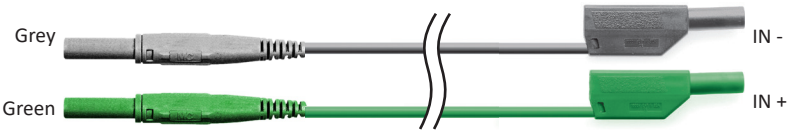
2) Add 0.03 % of range with no zero level.

3) LP filter in auto mode

4) SFDR excluding harmonics

5) ENOB calculated from SNR





WARNING

Risk of injury due to electric shock

Current measurement on lines above 33 V_{RMS}, 46.7 V_{PEAK} or 70 V_{DC} is only permitted with rated safety test leads.

TRION-POWER-SUB-dLV-5V

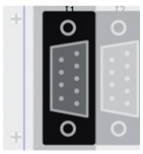
TRION-POWER-SUB-dLV-5V				
Range	5 V_{RMS} (±10 V_{PEAK}) **NOT ISOLATED** ⚠			
Resolution	18-bit			
Accuracy	DC	±0.015 % of reading ±200 µV		
	0.5 Hz to 10 kHz	±0.03 % of reading		
	10 kHz to 500 kHz	±(0.006 % * f) of reading	f: frequency in kHz	
	500 kHz to 3000 kHz	±(0.006 % * f) of reading	f: frequency in kHz	
Gain drift	10 ppm / °C			
Offset drift	10 µV / °C			
Typical THD	-100 dB			
Typical CMRR	>70 dB @ 50 Hz; >65 dB @ 10 kHz; >45 dB @ 100 kHz			
Bandwidth (-3 dB)	5 MHz			
Isolation voltage	None. Use with isolated current transducer.			
Common mode voltage	±10 V_{DC}			
Overvoltage protection	±300 V_{DC}			
Connector	D-SUB-9			
Input impedance	5 MΩ, 15 pF			
Sensor supply (±9 V)	Max. 40 mA			

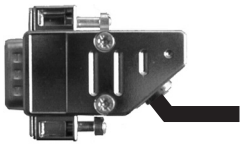
Sample rate	SNR [dB]	SFDR[1] [dB]	ENOB[2] [Bit]	$Noise_{PP}$ [µV]
0.1 kS/s	125	138	20.5	13
1 kS/s	122	135	20.0	21
10 kS/s	116	134	19.0	54
100 kS/s	108	134	17.7	152
1000 kS/s	99	134	16.2	489
2000 kS/s	96	134	15.7	712

Tab. 89: TRION-POWER-SUB-dLV-5V

1) SFDR excluding harmonics

2) ENOB calculated from SNR





Pin 1:	TEDS	Pin 6:	n.c.
Pin 2:	IN+	Pin 7:	IN-
Pin 3:	n.c.	Pin 8:	n.c.
Pin 4:	GND (not isolated)	Pin 9:	-9 V (40 mA max.)
Pin 5:	+9 V (40 mA max.)		

WARNING

Risk of injury due to electric shock

TRION-POWER-SUB-dLV-xV modules are not isolated.

DEWETRON

TRION-POWER-SUB-dLV-1V

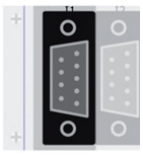
TRION-POWER-SUB-dLV-1V				
Range	1 V_{RMS} (±2 V_{PEAK}) **NOT ISOLATED** ⚠			
Resolution	18-bit			
Accuracy	DC	±0.015 % of reading ±200 µV		
	0.5 Hz to 10 kHz	±0.03 % of reading		
	10 kHz to 500 kHz	±(0.006 % * f) of reading	f: frequency in kHz	
	500 kHz to 3000 kHz	±(0.006 % * f) of reading	f: frequency in kHz	
Gain drift	10 ppm / °C			
Offset drift	10 µV / °C			
Typical THD	-100 dB			
Typical CMRR	>70 dB @ 50 Hz; >65 dB @ 10 kHz; >45 dB @ 100 kHz			
Bandwidth (-3 dB)	5 MHz			
Isolation voltage	None. Use with isolated current transducer.			
Common mode voltage	±10 V_{DC}			
Overvoltage protection	±300 V_{DC}			
Connector	D-SUB-9			
Input impedance	5 MΩ, 15 pF			
Sensor supply (±9 V)	Max. 40 mA			

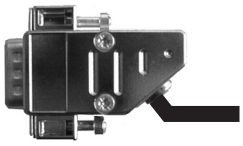
Sample rate	SNR [dB]	SFDR[1] [dB]	ENOB[2] [Bit]	$Noise_{PP}$ [µV]
0.1 kS/s	120	133	19.6	4.8
1 kS/s	117	130	19.2	6.3
10 kS/s	111	129	18.2	16.0
100 kS/s	104	129	17.1	49.0
1000 kS/s	95	129	15.5	162.0
2000 kS/s	92	129	15.0	243.0

Tab. 90: TRION-POWER-SUB-dLV-1V

1) SFDR excluding harmonics

2) ENOB calculated from SNR





Pin 1:	TEDS	Pin 6:	n.c.
Pin 2:	IN+	Pin 7:	IN-
Pin 3:	n.c.	Pin 8:	n.c.
Pin 4:	GND (not isolated)	Pin 9:	-9 V (40 mA max.)
Pin 5:	+9 V (40 mA max.)		

WARNING

Risk of injury due to electric shock

TRION-POWER-SUB-dLV-xV modules are not isolated.

DEWETRON

TRION-POWER-SUB-dLV-1

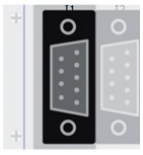
TRION-POWER-SUB-dLV-1				
Range	5 V_{RMS} (±10 V_{PEAK}) **NOT ISOLATED** ⚠			
Resolution	18-bit			
Accuracy[1]	DC	±0.02 % of reading ±0.02 % of range		
	0.5 Hz to 5 kHz	±0.03 % of reading		
	5 kHz to 30 kHz	±(0.01 % * f) of reading	f: frequency in kHz	
	30 kHz to 50 kHz	±(0.02 % * f) of reading	f: frequency in kHz	
	50 kHz to 100 kHz	±(0.1 % * f) of reading	f: frequency in kHz	
Typical THD	-100 dB			
Typical CMRR	>70 dB @ 50 Hz; >65 dB @ 10 kHz; >45 dB @ 100 kHz			
Isolation voltage	None. Use with isolated current transducer.			
Overvoltage protection	±30 V_{DC}			
Bandwidth	100 kHz			
Connector	D-SUB-9			
Input resistance	1 MΩ			
Sensor supply (±9 V)	Max. 40 mA			

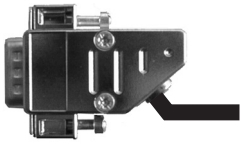
Sample rate	SNR [dB]	SFDR[4] [dB]	ENOB[5] [Bit]	$Noise_{PP}$ [µV]
0.1 kS/s	129	150	21.1	14.3
1 kS/s	119	142	19.5	45.3
10 kS/s	109	139	17.8	163.3
100 kS/s	99	131	16.2	590.1
1000 kS/s	94	124	15.3	1337.5
2000 kS/s	92	123	15.0	1375.7

Tab. 91: TRION-POWER-SUB-dLV-1

1) Below 1 % of range, add 25 ppm of range

2) Add 0.03 % of range with no zero level.





Pin 1:	TEDS	Pin 6:	n.c.
Pin 2:	IN+	Pin 7:	IN-
Pin 3:	n.c.	Pin 8:	n.c.
Pin 4:	GND (not isolated)	Pin 9:	-9 V (40 mA max.)
Pin 5:	+9 V (40 mA max.)		

WARNING

Risk of injury due to electric shock

TRION-POWER-SUB-dLV-1 modules are not isolated.