

HV2-2U2I for imc CRONOSflex (CRFX/HV2-2U2I)

Module for the measurement of high voltage and current

With the **HV2-2U2I** four-channel amplifier, two channels are available for measuring voltages up to 1000 V, and two channels to measure with current clamps and current transducers.

Highlights

- Measurement ranges from 1000 V_{RMS} to 2.5 V_{RMS}, selectable per channel to access voltages of 1000 V_{RMS} / 1414 V_{PK}
- Safety ratings:
600 V_{RMS} CAT III and 1000 V_{RMS} CAT II
test voltage 5.4 kV
- 48 kHz analog bandwidth (-3 dB)
- Measurement of current clamps, current transducers respectively low voltage signals
- Direct support for use of Rogowski coils



imc CRONOSflex High Voltage and Current Input module (example: CRFX/HV2-2U2I)

Typical Applications

- Power measurements, measurements on electric motors, batteries, fuel cells, etc.

imc CRONOSflex - Frameless expansion, flexible modularity

The imc Click Mechanism and extruded aluminum case provide a firm mechanical and electrical connection. As a result, no mainframe or rack is needed.

An imc CRONOSflex system uses EtherCAT as an "internal" system bus for connecting various modules to the main base unit (CRFX-400 / CRFX-2000G). With the system bus, all imc CRONOSflex modules are guaranteed to be synchronized with each other. This allows various modules to be either connected in one central block or connected via standard network cable in a spatially distributed system. In addition, when a module is added it is automatically recognized by the software displaying its dynamically assigned ID on the front of the module.

Alternatively, connection can be made by means of standard Ethernet cables (RJ45, CAT5), thus creating a spatially distributed system.



imc Click Mechanism



imc CRONOSflex distributed system

Overview of the available variants

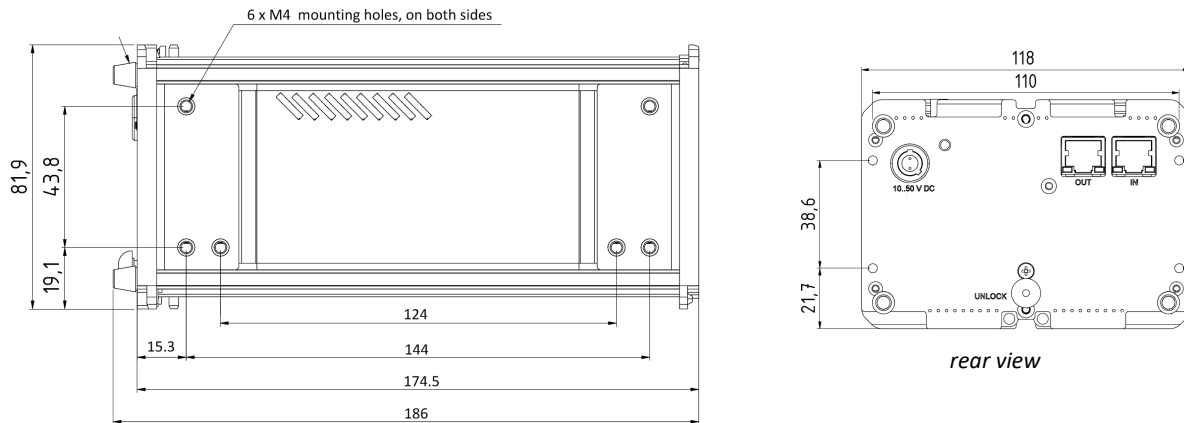
Order Code		article no.	ET version *
CRFX/HV2-2U2I	high voltage, 4 channel (2 voltage, 2 current transducer)	11900119	11910073

* ET: Version in extended temperature range

Terminal connections

- Measurement inputs: 2 pairs of safety banana jacks
2x 3-pin Phoenix terminals
- System bus (EtherCAT): 2x RJ45 sockets
- Power supply plug: LEMO.EGE.1B.302 (female) multicoded
- Module connector: 2x 20 pin (System bus and power supply)

Mechanical drawings with dimensions



Module power supply options

- Direct connection (LEMO.EGE.1B.302 power socket)
- Adjacent module (module connector / imc Click Mechanism)
- EtherCAT network cable: Power over EtherCAT (PoEC)

For further details refer to the power options documentation.

Accessories and Connectors

Included accessories

Phoenix connectors	
2x 3-pin Phoenix connector for HV current inputs	13500044
Miscellaneous	
Calibration certificate with test equipment verification as per DIN EN ISO 9001 (manufacturer's calibration certificate, PDF)	
Getting started with imc CRONOSflex (one copy per delivery)	

Optional accessories

AC Rogowski coils for HV		article no.
SEN/ROGOWSKI-25CM	Flexible current transducer (Rogowski), max. 10 kA AC, 1000 V CAT III, 25 cm (Chauvin Arnoux MiniFLEX), 3 m cable	13950025

AC Rogowski coils for HV		article no.
SEN/ROGOWSKI-45CM	Flexible current transducer (Rogowski), max. 10 kA AC, 1000 V CAT III, 45 cm (Chauvin Arnoux AmpFLEX), 3 m cable	13950026
SEN/ROGOWSKI-50CM	Flexible current transducer (Rogowski), max. 10 kA AC, 1000 V CAT III, 50 cm (Chauvin Arnoux AmpFLEX), cable: individual 0.5 m to 10 m	13950031
SEN/ROGOWSKI-80CM	Flexible current transducer (Rogowski), max. 10 kA AC, 1000 V CAT III, 80 cm (Chauvin Arnoux AmpFLEX), cable: individual 3 m	13950027
AC Current clamps for HV		article no.
POL/ZSW-10A	Current clamp 10 A AC, 600 V CAT III, 20 mm (Chauvin Arnoux MN)	10700002
POL/ZSW-240A	Current clamp 240 A AC, 600 V CAT III, 20 mm (Chauvin Arnoux MN)	10700049
AC/DC Current transducer (Fluxgate-principle, with additional sensor supply module)		article no.
CRFX/SEN-SUPPLY-4	sensor supply for 4 current transducers or current clamps	11900245
SEN/LEM-IT65	LEM Fluxgate current transducer 65 A, including calibrated cable for CRFX/SEN-SUPPLY	13950024
SEN/LEM-IT205	LEM Fluxgate current transducer 200 A, including calibrated cable for CRFX/SEN-SUPPLY	13950003
SEN/LEM-IT405	LEM Fluxgate current transducer 400 A, including calibrated cable for CRFX/SEN-SUPPLY	13950018
SEN/LEM-IT1000	LEM Fluxgate current transducer 1000 A, including calibrated cable for CRFX/SEN-SUPPLY	13950021
SEN/DANI-DS50ID	DANISENSE Fluxgate current transducer 50 A, ASPC-Protection, including calibrated cable for CRFX/SEN-SUPPLY	13950022
SEN/DANI-DS600ID	DANISENSE Fluxgate current transducer 600 A, ASPC-Protection, including calibrated cable for CRFX/SEN-SUPPLY	13950023
High voltage safety measuring cord		article no.
ACC/KABEL-CATIII-SW	safety measurement cable, black 2 m IEC 1010, 1000 V CAT III, 4 mm banana plug	13500022
ACC/KABEL-CATIII-ROT	safety measurement cable, red 2 m IEC 1010, 1000 V CAT III, 4 mm banana plug	13500021

AC/DC power adaptor 110-230 VAC 50-60 Hz (with appropriate LEMO.1B.302 plug)		article no.
48 V DC / 150 W	ACC/AC-ADAP-48-150-1B	13500148
24 V DC / 60 W	CRPL/AC-ADAPTER-60W-1B	10800066
Power plugs		
ACC/POWER-PLUG-5	Power plug for DC supply LEMO.FGE.1B.302 plug (male, E-coded: 2 coding keys)	13500150
CRFX/MODUL-PP-90	Power plug for DC supply 90° angular LEMO.FHE.1B.302 plug (male, E-coded: 2 coding keys)	11900074
Supply module (Power Handle)		article no.
CRFX/HANDLE-POWER-L	Handle with system power supply 50 V 100 W, without UPS	11900058
CRFX/HANDLE-UPS-L	Handle with system power supply 50 V 100 W, UPS with lead-gel battery	11900043
CRFX/HANDLE-LI-IO-L	Handle with system power supply 50 V 100 W, UPS with Li-Ion battery	11900010
Passive-Handle		
CRFX/HANDLE-L	standard unpowered left handle	11900008
CRFX/HANDLE-R	standard unpowered right handle	11900007
Mounting bracket for increased stability (recommended for lifetime and robustness)		
CRFX/BRACKET-CON	assembly element for 2 modules	11900071
Mounting brackets for fixed installations		
CRFX/BRACKET-90	mounting bracket 90°	11900068
CRFX/BRACKET-180	mounting bracket 180°	11900069
CRFX/BRACKET-BACK	rear panel mounting element	11900070
CRFX/RACK	19" RACK for imc CRONOSflex Modules	11900066
CRFX/BRACKET-RACK	mounting element in the RACK	11900072
Miscellaneous		
CRFX/CAL-P Calibration report set for each device	Report set with manufacturer's calibration certificate and individual readings, as well as list of test equipment used (PDF). Meets requirements of ISO 17025	11900051

Technical Specs - CRFX/HV2-2U2I

General

Measurement modes and categories		
Parameter	Value	Remarks
Inputs	4	2 inputs for voltage 2 inputs for current measurement
Measurement modes	voltage measurement current measurement	e.g. current probes, rogowski coil
Measurement categories	600 V _{RMS} (CAT III) / 1000 V _{RMS} (CAT II)	conformant to EN 61010-1, EN 61010-2-030
Pollution Degree	2	according to EN 60664
Terminal connection	2x safety banana jacks 2x 3-pin Phoenix terminals	KGG-PC 4/3-F BK

Sampling rate, Bandwidth, Filter			
Parameter	Value typ.	min. / max.	Remarks
Sampling rate	≤100 kHz		per channel
Bandwidth	0 Hz to 48 kHz		-3 dB
Filter	low pass, high pass, band pass, AAF Butterworth, Bessel and Cauer		digital filter
type	low pass, high pass, band pass, AAF		
characteristic	Butterworth, Bessel and Cauer		
cut-off frequency	10 Hz to 20 kHz		in steps of 1, 2, 5
order	8th order		low pass, high pass
Anti-aliasing filter (AAF)	4. + 4. order low pass Cauer 8th order with $f_{\text{cutoff}} = 0.4 \cdot f_s$		band pass: high- and low pass
Resolution	16 Bit 24 Bit		output format is selectable for each channel individually: a) 16 Bit Integer b) 32 Bit Float (24 Bit Mantissa)
Isolation strength		5.4 kV _{RMS}	50 Hz, test voltage

Measurement modes

Voltage measurement			
Parameter	Value typ.	min. / max.	Remarks
Input ranges	$\pm 1000\text{ V}$, $\pm 500\text{ V}$, $\pm 250\text{ V}$, ... , $\pm 2.5\text{ V}$ $1000\text{ V}_{\text{RMS}}$, $500\text{ V}_{\text{RMS}}$, $250\text{ V}_{\text{RMS}}$, ..., $2.5\text{ V}_{\text{RMS}}$ $\pm 1414\text{ V}_{\text{PK}}$, $\pm 707\text{ V}_{\text{PK}}$, $\pm 354\text{ V}_{\text{PK}}$, ... , $\pm 3.4\text{ V}_{\text{PK}}$		nominal RMS continuous peak measurement range (valid measurements): $\geq \text{nominal range} \cdot \sqrt{2}$
Max. Overvoltage protection		$\pm 1450\text{ V}$	differential, continuous with operating temperature up to 70°C
Input impedance	2 M Ω		
Input coupling	DC		isolated
Gain error	0.02%	$\leq 0.05\%$	of the reading, at 25°C
Gain drift	$\pm 25\text{ ppm/K} \cdot \Delta T_a$	$\pm 60\text{ ppm/K} \cdot \Delta T_a$	$\Delta T_a = T_a - 25^\circ\text{C} $; ambient temperature T_a
Offset error	0.02% 0.04%	$\leq 0.05\%$ $\leq 0.1\%$ $\leq 0.2\%$	of range ranges $> \pm 5\text{ V}$ range $\pm 5\text{ V}$ range $\pm 2.5\text{ V}$
Offset drift	$\pm 20\text{ mV/K} \cdot \Delta T_a$ $\pm 2.0\text{ mV/K} \cdot \Delta T_a$ $\pm 0.1\text{ mV/K} \cdot \Delta T_a$	$\pm 35\text{ mV/K} \cdot \Delta T_a$ $\pm 3.5\text{ mV/K} \cdot \Delta T_a$ $\pm 0.5\text{ mV/K} \cdot \Delta T_a$	range $> \pm 100\text{ V}$ range $\leq \pm 100\text{ V}$ range $\leq \pm 10\text{ V}$ $\Delta T_a = T_a - 25^\circ\text{C} $; ambient temperature T_a
IMRR (isolation mode rejection ratio)	160 dB 80 dB 54 dB	130 dB 70 dB 44 dB	DC 50 Hz 1 kHz
Bandwidth	0 Hz to 30 kHz	0 Hz to 48 kHz	$< \pm 0.03\text{ dB}$ -3 dB
Phase error		$< \pm 1^\circ$	0 Hz to 20 kHz
Signal noise	$3.8\text{ mV}_{\text{RMS}}$ $0.6\text{ mV}_{\text{RMS}}$		bandwidth: 0.2 Hz to 48 kHz range $\pm 250\text{ V}$ range $\pm 2.5\text{ V}$

Channels for current measurement with current probes			
Parameter	Value typ.	min. / max.	Remarks
Input ranges	$\pm 5\text{ V}, \pm 2.5\text{ V}, \pm 1\text{ V}, \dots, \pm 50\text{ mV}$		modulation range $\geq \text{range} \cdot \sqrt{2}$
Overvoltage protection	$\pm 100\text{ V}$		long-term
Input impedance	20 M Ω		isolated
Gain error	0.02%	$\leq 0.05\%$	of the reading
Gain drift	$\pm 10\text{ ppm/K} \cdot \Delta T_a$	$\pm 25\text{ ppm/K} \cdot \Delta T_a$	$\Delta T_a = T_a - 25^\circ\text{C} $; ambient temperature T_a
Offset error	0.02%	$\leq 0.05\%$	of the measurement range
Offset drift	$\pm 10\text{ }\mu\text{V/K} \cdot \Delta T_a$ $\pm 50\text{ }\mu\text{V/K} \cdot \Delta T_a$	$\pm 100\text{ }\mu\text{V/K} \cdot \Delta T_a$ $\pm 20\text{ }\mu\text{V/K} \cdot \Delta T_a$	range $> \pm 0.5\text{ V}$ range $\leq \pm 0.5\text{ V}$ $\Delta T_a = T_a - 25^\circ\text{C} $; ambient temperature T_a
IMRR (isolation mode rejection ratio)	160 dB 145 dB 125 dB	160 dB 126 dB 100 dB	DC 50 Hz 1 kHz
Bandwidth	0 Hz to 30 kHz	0 Hz to 48 kHz	$< \pm 0.03\text{ dB}$ -3 dB
Phase error		$< \pm 1^\circ$	0 Hz to 4 kHz
Signal noise	$1\text{ }\mu\text{V}_{\text{RMS}}$	LSB	bandwidth: 0.1 Hz to 48 kHz

Current measurement with AC current clamp			
Parameter	Value typ.	min. / max.	Remarks
Input range	$10\text{ A}_{\sim}, 5\text{ A}_{\sim}, \dots, 2.5\text{ A}_{\sim}$		RMS-values, crest factor up to $\sqrt{2}$
Measurement error	0.3%	$\leq 0.8\%$ $\pm 1\text{ mA}$	50 Hz, sine, line centered
Bandwidth	40 Hz to 2 kHz		$< \pm 0.1\%$
Phase error	$\pm 1^\circ$	$< \pm 3^\circ$	40 Hz to 1 kHz

Channels for current measurement with Rogowski coil (AC)			
Parameter	Value typ.	min. / max.	Remarks
Measurement principle	time-based integrating		Internal signal conditioning includes integrator stage
Usable sensors (Rogowski coil)	50 $\mu\text{V/A}$ at 50 Hz		Current probes without active signal conditioning (no batteries required)
Input range	500 (A/s)/V, 1 (kA/s)/V, 2.5 (kA/s)/V, ..., 50 (kA/s)/V		the GUI display this value as an integrated value
Overload protection		$\pm 55\text{ V}$	long-term
Gain error	0.02%	$\leq 0.08\%$	of the reading at 50 Hz plus error of the sensor
Gain drift	$\pm 40\text{ ppm/K} \cdot \Delta T_a$	$\pm 100\text{ ppm/K} \cdot \Delta T_a$	$\Delta T_a = T_a - 25^\circ\text{C} $; ambient temperature T_a plus error of the sensor
Bandwidth	0.5 Hz to 30 kHz	0.1 Hz to 48 kHz	$< \pm 0,1\%$ -3 dB

Current measurement with Rogowski coil			
Parameter	Value typ.	min. / max.	Remarks
Sensor (accessory)	flexible current transducer		
Input range	5 kA_{\approx} , 2,5 A_{\approx} , ..., 50 A_{\approx}		RMS-values, crest factor < 1.5
Overload protection		$\leq 60\text{ kA}_{\approx}$ $\leq 1\text{ kA}_{\approx}$	long-term, crest factor < 1.5 $f \leq 1\text{ kHz}$ $f \leq 50\text{ kHz}$
Measurement error	0.3%	$\leq 0.5\%$ $\pm 1\text{ A}$	See manual for recommended application of Rogowski coil

Operating conditions

Operating conditions		
Parameter	Value	Remarks
Operating environment	dry, non corrosive environment within specified operating temperature range	
Rel. humidity	80% up to 31°C, above 31°C: linear declining to 50%	according IEC 61010-1
Ingress protection rating	IP20	
Pollution degree	2	
Operating temperature (standard)	-10°C to +55°C	without condensation
Operating temperature (extended: "-ET" version)	-40°C to +85°C	condensation temporarily allowed
Shock- and vibration resistance	IEC 61373, IEC 60068-2-27 IEC 60062-2-64 category 1, class A and B MIL-STD-810 Rail Cargo Vibration Exposure U.S. Highway Truck Vibration Exposure	
Extended shock- and vibration resistance	upon request	specific tests or certifications upon request
Dimensions	82 x 118 x 186 mm	W x H x D
Weight	1.12 kg	

Further Terminal connections of this module		
Parameter	Value	Remarks
EtherCAT connection	2x RJ45	system bus for distributed imc CRONOSflex components
Input supply plug (female)	LEMO.EGE.1B.302	multicoded 2 notches for optional individually power supply
Module connector	2x 20 pin	direct connection of modules (click) supply and system bus

Power supply of this imc CRONOSflex module		
Parameter	Value	Remarks
Input supply voltage	10 V to 50 V DC	
Isolation	60 V	nominal isolation specification of the supply input
Power-over EtherCAT (PoEC)	42 V to 50 V DC	supply via EtherCAT network cable
Power consumption	5.8 W	10 to 50 V DC

Pass through power limits	
Directly connected (clicked) imc CRONOSflex Modules	3.1 A (maximum current) Equivalent power with chosen DC power input: <ul style="list-style-type: none">• 149 W @ 48 V DC (e.g. AC/DC line adapter)• 37 W @ 12 V DC (typical vehicle supplied DC input)
Power over EtherCAT (PoEC) for remote imc CRONOSflex Modules	350 mA (maximum current corresponding IEEE 802.3) Equivalent power with chosen DC power input: <ul style="list-style-type: none">• 17.5 W @ 50 V DC (e.g. Power Handle)• 16.8 W @ 48 V DC (e.g. AC/DC line adapter)• 14.7 W @ 42 V DC (minimum voltage for PoEC) Note: minimum system power of 42 V DC required for PoEC