imc CRONOS*flex*

flexible • expandable • fast

Frameless modular measurement system for electromechanical testing

imc – productive testing

imc CRONOS*flex* at a glance

- Flexible modularity through frameless expansion
- Click mechanism connects modules electrically and mechanically
- Centralized or distributed, put the pieces where you need
- Simultaneous recording of analog, digital, and fieldbus/vehicle bus data
- Up to 2000 kS/s per system and up to 100 kS/s per channel
- Supports virtually any physical sensor and signal type
- Synchronous acquisition of one to thousands of channels
- Integrated real-time analysis and control
- Standalone, remote or interactive operation (via Ethernet TCP/IP connection)
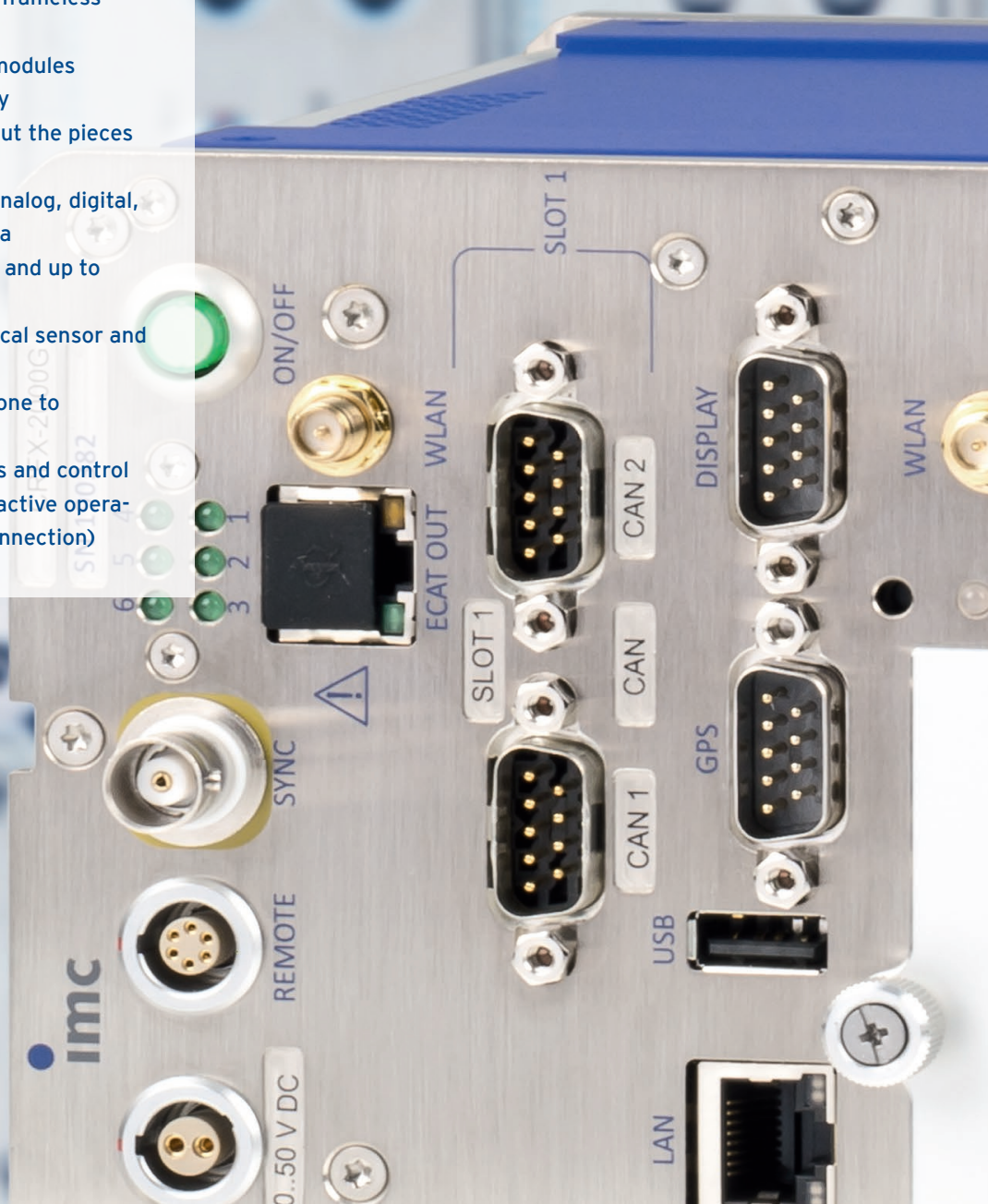
imc CRONOS*flex*

Experience true flexibility in test and measurement

imc CRONOS*flex* gives you a degree of flexibility never before possible. By simply clicking an imc CRONOS*flex* module, or modules, to a base unit, you've created a complete system, with exactly the number of channels you need. No cables between cards, no half empty mainframe rack, and no expansion chassis to squeeze in one more channel.

A perfect fit every time: from test stand and bench top, to mobile testing environments, the modular imc CRONOS*flex* measurement system provides you with the versatility you need for day-to-day changes, over a diverse range of measurement and control tasks, but without the need to make any sacrifices of performance or ease of use.

Click mechanism – connects modules electrically and mechanically
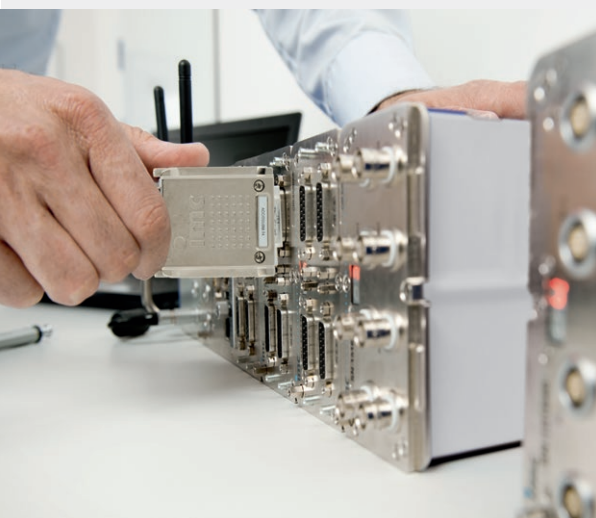
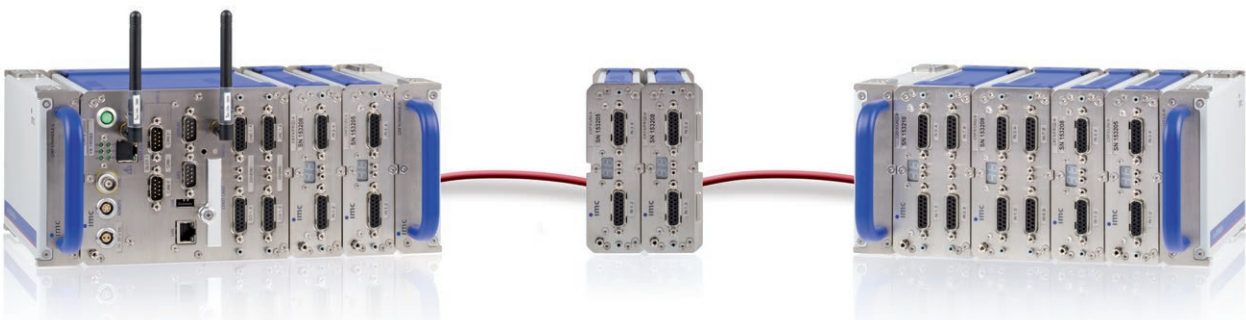|								
Voltage & high voltage	Current	Temperature	Strain gauge	Frequency speed/angle	Digital input/output	IEPE/ICP acceleration	Audio	Analog output

Enhancing your testing productivity

Gaining flexibility

- Frameless modular system easily adapts to changing demands of day-to-day testing in the field or on the test bench. Add, replace or relocate the modules wherever it is convenient for you, your signals and your testing
- Flexibility for remote monitoring in both centralized and Ethernet distributed networks
- Versatile expansion modules for multi-channel, mixed signal recording

Saving time

- Real-time calculations, analysis and data reduction by the measurement device itself
- With the click mechanism, an optimized solution or the reconfiguration of modules can be achieved in a matter of seconds
- Fast transition between measurement setups and locations
- imc's unique breakout connectors provide quick connections for any sensor, and optional support for automatic sensor recognition (TEDS)

Saving money

- The modular system design allows the investment to be easily tailored, segmented and spread over long-term budget planning – yet at a very low entry price for a minimum working configuration

Gaining clarity & synchrony

- No cables, no screws, no fuss – modules can simply be clicked together in order to expand or reorganize the system
- Due to the internal EtherCAT system bus, measurement modules are synchronized with each other. No further settings necessary

Gaining independence & security

- PC-less, standalone operation with internal storage. Because it can be operated PC-independent, the system maintains reliability even in harsh environments
- Intelligent power supply with optional short-term (UPS) or long-term power (Li-ion battery)
- Reliable operation and guaranteed data integrity, even in the event of power failure

In Practice

Mix-and-match test stand expansion

When managing short-run test stands that are reconfigured every few days or weeks, the ability to easily adapt test stand hardware can save days of engineering downtime. By assigning an imc CRONOS*flex* base unit to each of your test stands, you can mix and match the input modules as the test requires. Because the configuration and operation software automatically recognizes hardware changes, you will find it easy to adapt previous configurations – proven and etablished – into new and expanded setups, resulting in test configuration productivity gains.
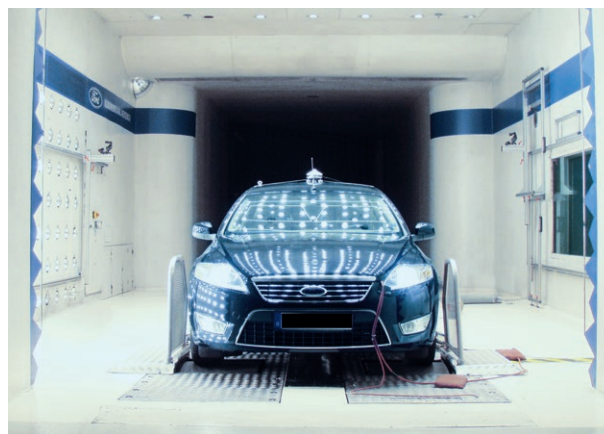
Add channels when tests demand it

"Since our initial specification for a new test system was based on an older test concept, I suspected we were going to need more channels later on." With the lower entry-price, there's no need for a large chassis or unnecessary modules "just in case." When the time comes to expand input capabilities by adding additional modules, everything you've already invested in your current imc CRONOS*flex* system still works the same. With per-module prices well below complete system prices, you can always expand without breaking your budget.

Distributed systems avoid analog noise

Solving the problem of signal noise and interference has never been easier. Unlike chassis-based systems, data collection and synchronization via the EtherCAT backbone of the imc CRONOS*flex* system can be accomplished without having the input modules installed in a mainframe chassis. Modules can be daisy-chained and distributed up to 100 meters away via noise-free standard Ethernet cable. This allows you to locate inputs and digitizers close to the signal source, especially when working in electrically "noisy" environments, like test cells and electric vehicles.

Designed for both centralized and distributed operations

imc STUDIO
Measurement software

Ethernet TCP/IP
RJ45/CAT5 & WLAN

Base unit

EtherCAT
RJ45/CAT5

EtherCAT
RJ45/CAT5
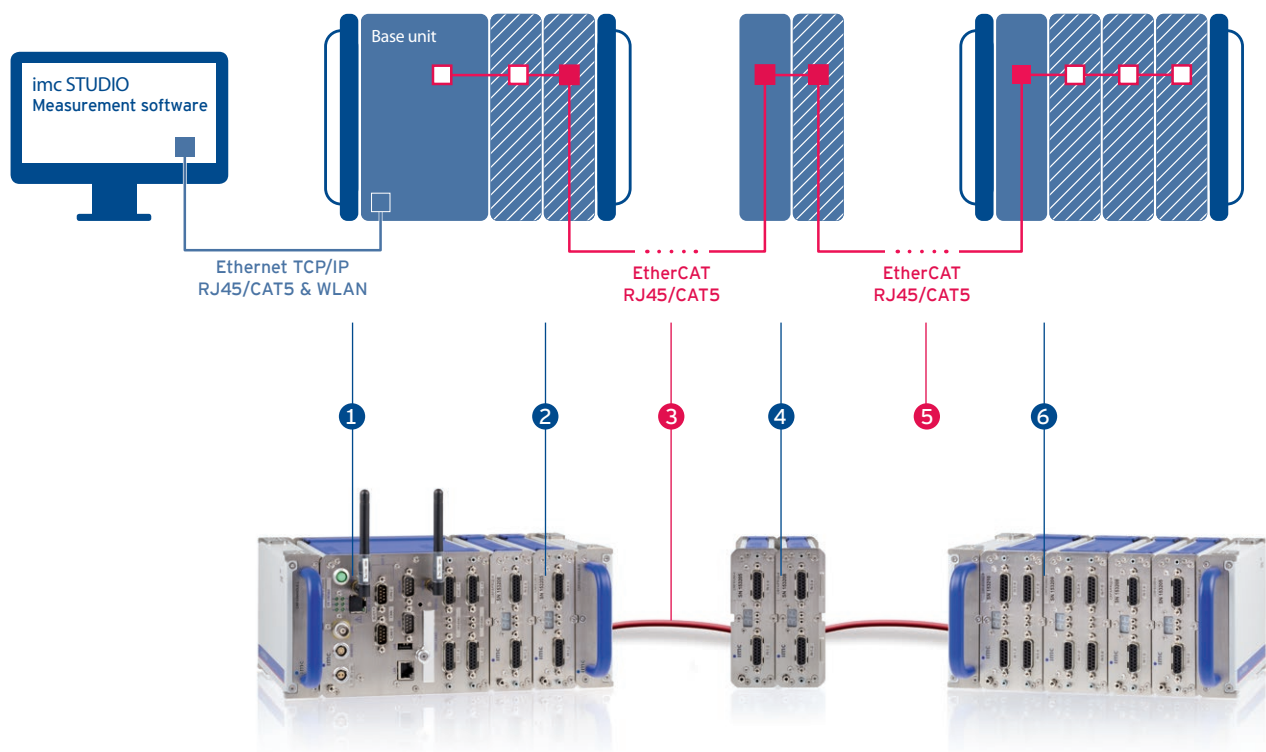
1 imc CRONOS*flex* base unit	**4** Modules may be located wherever convenient
2 Measurement modules "clicked" to base	**5** Optional isolated fiber optic connectivity
3 Decentralized distribution up to 100m via standard CAT5 network cable	**6** Distributed measurement module satellite stack synchronously connects with only one cable

Flexible mounting

In addition to the self-supporting housings, there are matching mounting options for various applications.

e.g., for mobile applications

e.g., 19''-rack for test stand applications

e.g., for fixed installations

Design Concept

imc CRONOS*flex* base unit

The base unit is the heart of the system:

- TCP/IP Ethernet interface for system configuration and interactive data collection
- Onboard data storage on removable flash media or optional hard drive
- Onboard real-time signal processing and test control with imc Online FAMOS
- GPS (for time and/or position information) and external display connectivity
- Stand-alone startup and power-failure control logic, including several battery options

Two speed grades and build time options

imc CRONOS*flex* is available with aggregate data collection rates of either 400 kSample/s or 2000 kSample/s per system.

In addition, a base unit may be configured with CAN or other fieldbus interface extensions, digital I/O, counter and analog output extensions. The base unit options extend the general functionality of the system, detailed in the imc CRONOS*flex* base unit table.

imc CRONOS*flex* modularity

With up to 100kSample/s per channel, integrated signal conditioning and sensor power supplies, imc CRONOS*flex* modules are up to the toughest data acquisition challenges, while performing under demanding environmental conditions. The input modules are compatible with virtually every physical sensor and signal type, and integrate not only sensor signal conditioning, but also filtering and digitizing in a single, compact, field-swappable unit.

Digital I/O, analog output and control

Logging of analog inputs is only part of the story when it comes to complete test systems. As with all imc data acquisition systems, imc CRONOS*flex* is also well-suited to interact with the test environment, including discrete digital inputs and outputs, as well as analog outputs (e.g., proportional control) and CAN I/O.

Real-time functionality at your fingertips

One of the core concepts of all members of the imc CRONOS familiy is integrated synchronous control: an extensive array of real-time functionality.

Control signals and simple logic are often handled without the need for any programming, directly through imc's powerful trigger engine.

For advanced real-time analysis and control, imc Online FAMOS is available as an enhancement. This option provides the capability of handling tasks ranging from basic statistical operations, such as minimum/maximum, average and RMS, to more demanding calculations, such as FFT spectral analysis, signal classification (fatigue analysis) and order tracking. Virtual channels are computed on the fly, in real time.

In addition, imc Online FAMOS extends the capability of your system to easily create PLC-like control functionality with minimal specialized knowledge. Incorporating responsive real-time and closed loop control (incl. PID), the system can thus handle complete test stand automation.

One software for the entire testing process

imc STUDIO – the modular software for measurement, control and automation

Whether you want to use your imc imc CRONOS*flex* in a "black box" configuration for easy data acquisition, or you want to set up Live-Monitoring on hundreds of channels during prototype testing, or you want to create a complete test stand automation routine with its own control panel – with imc STUDIO, you have full control over the entire measurement process.

Configuration & measurement
imc STUDIO Setup

- Simple measurement device selection
- Clear configuration of all hardware settings
- Intelligent trigger machine
- Flexible, real-time calculations
- Structured project management

Visualization & displays
imc STUDIO Panel (Standard)

- Versatile imc Curve Window configurations (2D/3D)
- Display live video
- Freely customize control & display elements per drag & drop
- Create reports
- Data browser for navigating through large volumes of data

Testing sequences
imc STUDIO Sequencer

- Automation of test and evaluation procedures
- Configuration per Drag & Drop
- From sequence control to automated data evaluation and report creation
- imc FAMOS & MATLAB interface

User interface
imc STUDIO Panel (Professional)

- Intelligent instruments (Widgets) and control elements
- Individually customizable GUIs
- Additional application-oriented components for user interfaces
- Full-screen display
- User rights management

Test stand automation
imc STUDIO Automation
- Real-time automation platform
- Graphical design environment for test stands and test setups per Drag & Drop or notation
- imc hardware provides the necessary deterministic timing
- Threshold monitoring in the background

Efficient system integration

- Integration of DLLs
- Scripting engine (.Net)
- Integrated workbench
- Connection to 3rd-party devices
- Implement your own data-stream analysis
- LabVIEW interface (VI's)
- DIAdem interface

imc STUDIO Standard

imc STUDIO Professional

imc STUDIO Developer
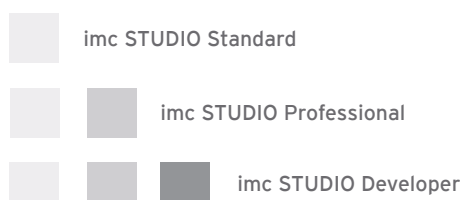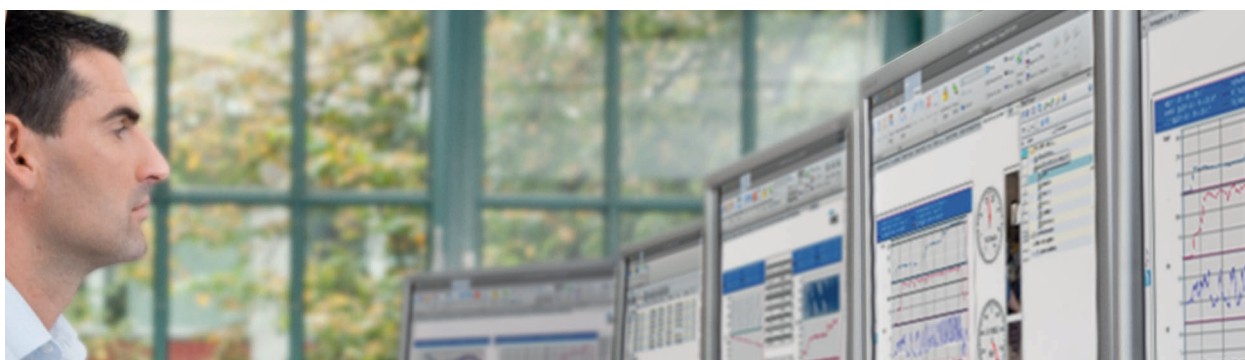
Live data analysis
imc Online FAMOS / imc Inline FAMOS

- Analyze and calculate live data streams
- "Immediate results" during the running measurement
- Autarkic in the device (imc Online FAMOS)
- PC based with scalable performance (imc Inline FAMOS)
- Simple syntax

Analysis & documentation
imc FAMOS

- Powerful data analysis and documentation
- Full range of pre-defined calculation functions
- Create multi-layer macros
- Create user-defined GUIs
- Control large amounts of data

Video integration
imc STUDIO Video

- Time-synchronized video and measurement data acquisition
- Pre-trigger function
- Up to 4 simultaneous video cameras
- 2 redundant channels per camera with independent sampling and trigger settings (monitor channels)

Webserver
imc REMOTE

- Configurable homepage for displaying and operating imc measurement devices
- Platform-independent device access with standard internet browser
- Web Design Wizard for creating individual web pages
- Supports https (SSL) for secure connection

Sensor management
imc SENSORS

- Management of any sensor
- Measurement channel configuration from sensor database per Drag & Drop
- Descriptions from TEDS

Remote Testing
imc LINK / imc WEBDEVICES

- Remote connection for imc measurement systems via WiFi or mobile radio
- Automatic measurement data transfer to the PC or server
- Automated evaluations
- GPS data on map background
- Turnkey solutions including IT & service

imc STUDIO Plug-In

Additional software

Facts & Features

imc CRONOS*flex* Details

imc CRONOS*flex* base unit

	CRFX-400	CRFX-2000G
General		
Aggregate sampling rate	400 kSps	2000 kSps
Operating conditions		
Standard operating temp. range	●	●
Extended temp. range (incl. condensation)	○	○
Shock and vibration rating	MIL 810F (40g)	
Connectivity		
Ethernet	100 MBit	1 GBit
W-LAN (WiFi) IEEE 802.11.g (54 Mbit/s)	○	○
Dual band IEEE 802.11.n (300 Mbit/s)		○
Wireless UMTS, 3G, 4G	○	○
EtherCAT distributable system bus	●	●
GPS connection port	●	●
Display connection port	●	●
Remote controlled main switch	●	●
Programmable status feedback (LEDs)	●	●
Isolated SYNC signal	●	●
Data storage		
CF card slot (Compact Flash)	●	
CFast card slot		●
USB 2.0 host port (external removable storage)		●
Storage on PC / network drive	●	●
Hard disk (internal)	○	○
Stand-alone capabilities		
PC independent complex trigger functionality	●	●
Onboard real-time data analysis (imc Online FAMOS)	●	●
Autarkic PC-less operation, self start	●	●
Synchronization & clock		
Master-slave between different imc systems	●	●
NTP network based synchronization	●	●
PTP network synchronization (precision)		●
Via external GPS signal	●	●
Via external IRIG-B & DCF-77 signal	●	●
Field bus extensions		
CAN, CAN FD	○	○
LIN	○	○
FlexRay	○	○
MVB	○	○
ARINC	○	○
XCPoE (Master, Slave)	○	○
EtherCAT Slave	○	○
Multi-functional I/O extension of base unit		
Digital in/out, pulse counter, analog out	○	○
Power supply		
DC input 10V to 50V	●	●
AC/DC adapter (110 to 230VAC)	●	●
Supply of remote modules via Power-over-EtherCAT	●	●
Data integrity upon power fail	●	●
UPS (lead gel battery)	○	○
UPS (extended capacity Li-Ion)	○	○

CRFX-400

CRFX-2000GP

HANDLE-LI-IO-L

DI-16-HV

ICPU2-8

ISO2-16-2T

UNI-4

UNI2-8

HV-2U2I

HV-4U

imc CRONOS*flex* analog amplifier modules

module name CRFX/xxx	channels	width (type)	standard connector	LEMO version available	TEDS	max. sampling rate (per channel)	signal bandwidth (-3dB)	isolated voltage mode	min. voltage range (mV)	voltage up to 10 V	voltage up to 50/60 V	voltage up to 1000 V	20 mA internal shunt	20mA shunt plug	Thermocouple (TC)	RTD (PT100)	ICP mode integrated	Charge mode integrated	ICP plug	sensor supply (per channel)	full bridge	half bridge	quarter bridge	DC excitation	AC excitation (CF)	single SENSE	double SENSE
Voltage measurement																											
LV3-8	8	1	DSUB-15	○	●	100 kHz	11 kHz		5	●	●			●					○	○							
Voltage & temperature measurement																											
ISO2-8	8	1	DSUB-15	○	●	100 kHz	11 kHz	●	50	●	●			●	●	●			○	○							
ISO2-8-2T	8	2	Thermo			100 kHz	1 kHz	●							●												
ISO2-16-2T	16	2	Thermo			100 kHz	2 kHz	●							●												
ISO2-8-L	8	2	LEMO.1B	●	●	100 kHz	11 kHz	●	50	●	●		●		●	●				○							
ISOF-8	8	1	DSUB-15	○	●	100 kHz	48 kHz	●	50	●	●		●		●	●			○	○							
HISO-8-L	8	3	LEMO.1P REDEL	●		100 kHz	11 kHz	●	50	●	●		●			●											
HISO-8-T-L	8	3	LEMO.2P REDEL	●		100 kHz	1 kHz	●							●												
High voltage measurement 600V CAT III																											
HV-4U (U-chan)	4	3	Banana			100 kHz	14 kHz	●	2,500	●	●	●															
HV-2U2I (I-chan)	4	3	Banana/Terminal blocks		●	100 kHz	14 kHz	●	2,500/50	(●)																	
Audio & vibration measurements																											
ICPU2-8	8	2	BNC		●	100 kHz	48 kHz		5	●	●						●		●								
AUDIO2-4	4	2	BNC		●	100 kHz	48 kHz	●	5	●	●						●		●								
AUDIO2-4-MIC	4	2	BNC, LEMO.1B	●	●	100 kHz	48 kHz	●	5	●	●						●		●							●	●
Charge																											
QI-4	4	2	BNC		●	100 kHz	48 kHz	●	5	●	●						●	●									
Bridge & strain gauge measurements																											
BR2-4	4	1	DSUB-15	○	●	100 kHz	14 kHz		5	●	●				●				○	(●)	●	●	●	●	●	●	●
B-8	8	2	DSUB-15	○	●	100 kHz	48 kHz		5	●			●	●					○		●	●	●	●			
BC-8	8	1	DSUB-26-HD			100 kHz	48 kHz		5	●			●	●							●	●	●	●			
DCB2-8	8	2	DSUB-15	○	●	100 kHz	5 kHz		5	●									○		●	●	●	●			
DCBC2-8	8	1	DSUB-26-HD			100 kHz	5 kHz		5	●			●	●							●	●	●	●			
For universal use																											
UNI2-8	8	2	DSUB-15	○	●	100 kHz	48 kHz		5	●	●		●	●	●				○		●	●	●	●		●	
UNI-4	4	1	DSUB-15	○	●	100 kHz	48 kHz	●	2.5	●	●		●	●	●	●			○	●	●	●	●	●		●	●

imc CRONOS*flex* DIO, pulse counter, DAC modules

module name CRFX/xxx	width	standard connector	input Bits	high voltage	output Bits	high current	analog outputs	counter inputs	quadrature mode chan	counter frequency	analog sin/cos mode
Base unit extension											
DI16-DO8-ENC4	+40mm	DSUB-15	16		8			4	2	32 MHz	
DI8-DO8-ENC4-DAC4	+40mm	DSUB-15	8		8		4	4	2	32 MHz	
flex modules: pulse counter											
HRENC-4	1	DSUB-15						4	4	256 MHz	●
flex modules: digital I/O, DAC											
DI2-16	1	DSUB-15	16								
DI2-32	2	DSUB-15	32								
DO-16-HV (110V)	2	Terminal blocks		●	16						
DO-16-HC	1	DSUB-15			16	●					
DO-32-HC	2	DSUB-15			32	●					
DI2-16-DO-16-HC	2	DSUB-15	16		16	●					
DAC-8	1	DSUB-15					8				
DO-16-HC-DAC-8	2	DSUB-15			16	●	8				

TEDS support
(Transducer Electronic Data Sheet)
imc CRONOS*flex* modules support direct read/write of TEDS sensors, including imc's TEDS Clip. Connectors: TEDS interfaces require either the ACC /DSUBTEDS-x variants of our connectors or per-channel connectors such as Lemo. "IEPE" type TEDS is supported in audio modules with direct BNC input connectors.

Digital I/O
galvanically isolated, configurable to 24V/5V (TTL/CMOS) Level, output: 0.7A sink, high current: sink and source 0.7A

Pulse Counter
full analog input conditioning: 500 kHz analog bandwidth, differential input, analog filter, software adjustable threshold levels
Modes: event counter, time, frequency, speed, RPM differential and absolute angle and displacement

Facts & Features

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