imc CANSASflex-SC16

16 channel CAN measurement module for voltage, current (20 mA) and temperature

The imc CANSAS*flex*-SC16 measurement module is a 16 channel CAN bus measurement amplifier that comprises analog conditioning of physical sensor signals, digitization and output via CAN bus. The multiplexed differential inputs allow (depending on the variant) acquisition of:

- Voltage (100 mV to 10 V)
- Current (20 mA sensors)
- Temperature (thermocouple, RTD/PT100)

imc CANSAS*flex*-SC16
(Fig. similar)

Module versions with DSUB-15 connectors support all measurement modes. Versions with alternative connectors, such as thermocouple inputs, support only these selected modes.

The module is available in both short and long housing.

Specific techniques aimed at noise and interference suppression (esp. block averaging) allow for very sensitive voltage and temperature measurements even in demanding environments, despite its multiplexed architecture. At a sampling rate of 1 Hz, this guarantees very stable measurements and an effective suppression of noise and aliasing caused by power line interference (50/60 Hz) and higher frequency disturbances.

Even the use of faster sampling rates is supported. However, since this operating mode does not provide full suppression of aliasing by line interference it should be limited to applications with signals of reasonable level and without significant spectral content (with respect to both noise and physical signal) beyond the selected sampling rate.

Highlights

- Measurement range and sampling rates can be set per channel in steps of 1, 2, 5
- Optimized for precise and robust measurement at 1 Hz sampling rate:
  with very good suppression of noise , interference and aliasing
- Isolation between channels: ±15 V
- 24 Bit digitization and internal processing, CAN-output format: 16 Bit
- Optional: adjustable sensor supply (e.g. for active voltage fed sensors)
- Support of imc Plug & Measure:
  TEDS (Transducer Electronic Data Sheets, IEEE 1451.4)

Typical applications

- High-precision measurements of voltage and temperature at low sampling rates.

General imc CANSAS*flex* functions and specifications

As a CAN-bus-based measurement engineering tool, the imc CANSAS*flex* series offers a wide selection of measurement modules which process and digitize sensor signals and output these as CAN-messages.

The modules of the imc CANSAS*flex* series (CANFX) can be joined together mechanically and electrically by means of a latching ("click") mechanism, without the use of any tools nor the need for any extra cables, and also allows the CAN-logger imc BUSDAQ*flex* (BUSFX) to dock on directly. Depending on the module type, they are available in either long (L-), short, or both housing versions.

Besides fixed installations or operation on a laboratory bench, the modules are also designed to fit in a special 19" subrack to provide a convenient solution in test station settings.

Fields of application

- For test rigs, vehicle testing, road trials and all-purpose measurement applications
- Deployable both in decentralized, distributed and in centralized measurement setups
- Operable with CAN-interfaces and CAN-data loggers from either imc or 3rd-party manufacturers

Properties and capabilities

Operating conditions:

- Operating temperature: -40°C to +85°C, condensation allowed
- Shock resistance: 50 g (pk over 5 ms)
- Ingress Protection rating: IP40 (only with optional protective cover on top of the locking slider, otherwise IP20)

CAN-Bus:

- Configurable Baud rate (max. 1 Mbit/s)
- Default configuration ex-factory: Baud rate=125 kbit/s and IDs: Master=2, Slave=3
- Galvanically isolated
- Built-in terminator resistance, manually switchable

Sampling rates and synchronization:

- Configurable CAN data rate
- Simultaneous sampling of all module's channels, as well as across multiple modules
- Synchronization of multiple modules as well as to a global CAN-logger: based on CAN messages (no Sync-signal required)

Power supply:

- Galvanically isolated power supply input
- DC 10 V to 50 V
- LEMO.0B connector (2-pin); alternative power supply via CAN connector (DSUB-9)

On-board signal processing:

- "Virtual channels": integrated signal processor (DSP) for online processing. Data reduction, filtering, scaling, calculations, threshold monitoring, etc.
- Programmable multi-functional status-LED, supporting linkage to virtual channels

Heartbeat-message:

- Configurable with cyclical "life-sign", e.g. for integrity check purposes in test rigs
- Contains checksum for configuration and serial number, e.g. for consistency monitoring (checking of whether the correct module is still being used, for instance in installations undergoing maintenance)

FindMe:

- Identification of a module by means of selective LED flashing (via configuration software; does not occupy any additional CAN messages)

flex-Series: flexible granulation, topology and block assemblies

Click-mechanism:

- Modules joinable to module-blocks: mechanically and electrically connected (CAN and power supply)
- No tools or additional cabling required
- With guide grooves, magnetic catches and locking slider
- Both short and long housing versions joinable:
  with electrical connection: align on rear side; mechanically only: align on front side
- Direct connection of compatible CAN-logger: imc BUSDAQ*flex*

19” rack solution (subrack):

- Modules designed for insertion into special 19” frames (“boom-box”) for installation in test stations
- Rack backplane accommodates the power supply, CAN and slot information (automatically read out configuration information for use in automation software)

Mounting:

- Mountable by means of recessed threaded holes (M3), either individually or jointly as a block
- Rubber bumper rails providing secure placement in laboratory settings
- Various brackets and handles, and DIN top-hat rail mounting kit available as accessories

imc CANSAS*flex* modules connected (Click-mechanism)
in a block with imc BUSDAQ*flex* Logger (left)

rear view of this block:
CAN, Power supply, Terminator, Locking slider

Software

Configuration:

- Using imc CANSAS software (free of charge), including dbc-export
- Autostart with saved configuration; also pre-configurable at factory
- The module's current configuration can be read out and exported by the software; For transfer of configuration via physical transport of the module; for back tracing and recovery.
- Supports the CANopen® protocol according "CiA® DS 301 V4.0.2" and "CiA® DS 404V1.2";
  4 TPDOs (Transmit Process Data Objects) in INT16, INT32 and FLOAT.
  See "CANSAS CANopen®" for a detailed description of the supported features and settings.

Measurement operation:

- Data logger operation:
  Software: imc STUDIO
  Hardware: imc measurement system with CAN-Interface, e.g.
  imc BUSDAQ, imc C-SERIE, imc SPARTAN
  imc CRONOS device family (CRFX, CRC, CRSL, CRPL)
- Basic measurement operation with imc CANSAS*pro*
- With any desired CAN-interfaces and CAN-loggers from 3rd-party manufacturers

Models and Options

Overview of the available variants for imc CANSASflex-SC16

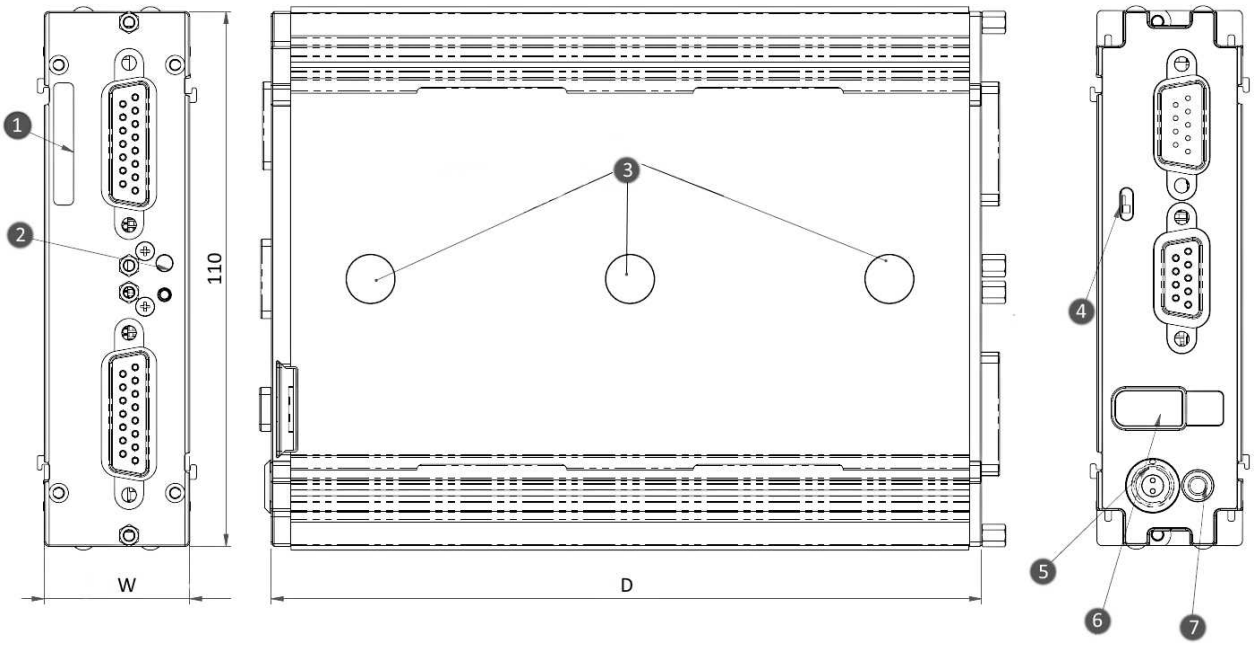
Order Code	signal connection	option/extra	housing	article number
CANFX/SC16	DSUB-15		S1	1250039
CANFX/L-SC16	DSUB-15		L1	1250040
CANFX/L-SC16-SUPPLY	DSUB-15	Sensor supply	L1	1250054
CANFX/L-SC16-2T	thermocouple terminal connector	type K	L2	1250048

Additional-Option (Order option ex-factory)

- Variants with integrated Sensor supply, configurable voltage settings

Mechanical drawings with dimensions

front side view rear view



Shown in standard operating orientation: housing type L0; width (W) = 30 mm.

Housing type	S0	S1	S2	L0	L1	L2
W: Width	30 mm	50.3 mm	70.6 mm	30 mm	50.3 mm	70.6 mm
D: Depth	93 mm, with two magnets			146.5 mm, with three magnets		

Legend:

1: Serial number label
2: Status LED (blue / red)
3: magnet (depending on model)
4: adjustable CAN terminator
5: supply socket (LEMO)
6: locking slider CAN/supply
7: ground connection M4

Accessories and Connectors

Included accessories

- Calibration certificate with test equipment verification as per ISO 9001 (manufacturer's calibration certificate)

Optional accessories

AC/DC power adaptor 110-230V AC (with appropriate LEMO plug)		
ACC/AC-ADAP-24-60-0B	24 V DC, 60 W, LEMO.0B.302	1350246

Power connector		
ACC/POWER-PLUG3	Power connector for DC supply LEMO FGG.0B.302, solder contact, max. 0.34 mm^2	1350033
ACC/CABLE-LEMO-BAN-2M5	Power supply cable LEMO/banana 2.5 m	13500xx

DSUB-9 connector (CAN)		
CAN/RESET	Reset-plug	1050025
CAN/KABEL-TYP2	CAN-Bus connection cable 2x DSUB-9 1:1, 2 m length	1050027

DSUB-15 connector (measurement inputs)		
ACC/DSUBM-U4	DSUB-15 plug with screw terminals for 4-channel voltage measurement.	1350166
ACC/DSUBM-TEDS-U4	U4 plug variant with TEDS support, according IEEE 1451.4 for use with imc Plug & Measure	1350189
ACC/DSUBM-I4	DSUB-15 plug with screw terminals for 4-channel current measurement of up to 50 mA (shunt 50 Ω, scaling factor 0.02 A/V)	1350168
ACC/DSUBM-TEDS-I4	I4 plug variant with TEDS support, according IEEE 1451.4 for use with imc Plug & Measure	1350192
ACC/DSUBM-T4	DSUB-15 plug with screw terminals for 4-channel measurement of voltages as well as temperatures with PT100 and thermocouples with integrated cold junction compensation (CJC).	1350167
ACC/DSUBM-TEDS-T4	T4 plug variant with TEDS support, according IEEE 1451.4 for use with imc Plug & Measure	1350190

Handle		
CANFX/HANDLE-S	CANFX handle kit (left and right) - short (S)	1250027
CANFX/HANDLE-L	CANFX handle kit (left and right) - long (L)	1250028

Mounting brackets for fixed installations		
CANFX/BRACKET-CON-S	CANFX connection bracket short	1250019
CANFX/BRACKET-CON-L	CANFX connection bracket long	1250020

Mounting brackets for DIN Rail		
CANFX/BRACKET-DIN-S1	CANFX DIN Rail mounting bracket - Type S1	1250022
CANFX/BRACKET-DIN-L1	CANFX DIN Rail mounting bracket - Type L1	1250025
CANFX/BRACKET-DIN-L2	CANFX DIN Rail mounting bracket - Type L2	1250026

Miscellaneous		
Calibration report set for each device	Report set with manufacturer's calibration certificate and individual readings, as well as list of test equipment used. Meets requirements of DIN EN ISO 17025	
Instruction manual	Getting started with imc CANSAS	
CANFX/RUBBER-1M	silicone strip blue 1 m	1250029

Technical Specs - SC16

Parameter	Value	Remarks
Channels	16	4x DSUB-15 with each 4 channels
Measurement mode (DSUB)	voltage measurement current measurement temperature measurement: thermocouple, RTD (PT100)	standard plug (ACC/DSUBM-U4) shunt plug (ACC/DSUBM-I4) thermo plug (ACC/DSUBM-T4)
Measurement mode Thermocouple terminal socket (-2T)	thermocouple type-K	miniature thermocouple terminal

Sampling rate, Bandwidth, CANopen®, TEDS		
Parameter	**Value**	**Remarks**
Sampling rate	max. 500 Hz (2 ms) / channel	maximum allowable input signal frequency: 100 Hz The data rates 500 Hz and 200 Hz are based on a slower working sampling rate and will be interpolated.
Sampling rate, temperature	max. 1 Hz (1 s) / channel	recommended maximum for optimized noise reduction; filter: 12 Hz (-3 dB); -60 dB @ 50 Hz no restrictions for input signal frequency (except for narrow band 0.5 Hz to 12 Hz)
Bandwidth with compensation filter	28 Hz sampling rate / 7	at sampling rate 500 Hz (2 ms), 200 Hz (5 ms) 100 Hz (10 ms) to 2 Hz (500 ms)
Resolution	16 bit	
CANopen® mode	"CiA® DS 301 V4.0.2" and "CiA® DS 404V1.2" supports 4 PDOs in INT16, INT32, and FLOAT	in CANopen® mode: max. 100 Hz (10 ms) / channel
TEDS - Transducer Electronic DataSheets	conformant to IEEE 1451.4 Class II MMI	ACC/DSUBM-TEDS-xxx

General			
Parameter	typ.	min. / max.	Remarks
Block isolation CAN-bus DC supply input	±60 V ±60 V		each function block to case (CHASSIS) nominal; testing: 300 V (10 s) nominal; testing: 300 V (10 s)
Max. common-mode input voltage	±40 V		analog input to case (CHASSIS) nominal rating
Channel isolation	±40 V ±15 V		max. voltage between any two arbitrary input pins of different channels; max. fault protection for specified accuracy
Overvoltage protection	±40 V		differential channel input voltage (long-term)
Input configuration	DC, differential		isolated to: case, supply and CAN-bus
Input impedance (static)	10 MΩ 50 Ω		voltage mode current mode (Shunt plug)
Input current static dynamic on overvoltage condition	 2 nA (typ.) 0.2 mA (typ.) 20 nA (typ.) 0.1 µA	 25 nA (max.) 20 mA (max.) 2 µA (max.) 1 µA	dynamic input currents: (scanner/multiplexer) settled current at time of sampling peak dynamic input current (typ. @100 mV, max. @10 V) average dynamic input current (typ. @100 mV, max. @10 V) $\|V_{in}\|$ >15 V; or device powered-down
Noise 	 25 mV $_{pk-pk}$ 0.5 K $_{pk-pk}$ 6 mV $_{pk-pk}$	 5 µV $_{rms}$ 0.08 K $_{rms}$ 	sampling rate: 2 ms, R_s = 50 Ω range ±100 mV thermocouple type K sampling rate: 1 s, R_s = 50 Ω
Max. source impedance	5 kΩ		of sensor or signal source
Max. cable length (signal-input)	200 m		100 pF / m
Crosstalk (channel to channel)	< -105 dB		60 Hz, source impedance R_s = 100 Ω, range ±100 mV
CMRR / IMR	100 dB (50 Hz)		Common-Mode reference: case (CHASSIS) all other channels: CHASSIS

Voltage measurement			
Parameter	Value (typ.)	min. / max.	Remarks
Range	±10 V, ±5 V ±2 V, ±1 V ±500 mV, ±200 mV, ±100 mV		
Gain Error	<0.025 %	<0.05 %	at 25°C
Gain drift	30 ppm/K (typ.)	60 ppm/K (max.)	
Offset	<0.02 %		over entire temperature range
Linearity error	<50 ppm		range ±10 V

Current measurement with shunt connector			
Parameter	Value (typ.)	min. / max.	Remarks
Range	±40 mA, ±20 mA, ±10 mA, ±4 mA, ±2 mA		
Shunt impedance	50 Ω		
Gain Error	<0.075 %	<0.15 %	at 25°C
Offset	<0.02 %		over entire temperature range

Temperature measurement - Thermocouples			
Parameter	Value (typ.)	min. / max.	Remarks
Measurement modes	R, S, B, J, T, E, K, L, N		
Measurement range	-200°C to +1200°C		type: R, S, B, J, T, E, K, L, N (max. one type per configuration)
Temperature error	±0.2 K	<±0.5 K	type: J, T, K, E, L (for other types: see uncertainties of voltage measurements) at sampling rate ≥1 s
Drift	±0.02 K/K·ΔT_a		$\Delta T_a = \lvert T_a - 25°C \rvert$; ambient temp: T_a
Error of cold junction Compensation		<±0.15 K <±0.5 K	with imc plug ACC/DSUBM-T4 with SC16-2T
Drift of cold junction	±0.001 K/K·ΔT_j		$\Delta T_j = \lvert T_j - 25°C \rvert$ cold junction T_j

Temperature measurement - RTD measurement (PT100)			
Parameter	Value (typ.)	min. / max.	Remarks
Measurement range	-200°C to +850°C		mixed configuration with thermocouples supported; Use of thermo-plug provides complete set of terminals for full 4-wire connection scheme; reference current: 410 µA, int. calibrated
Measurement error		<±0.2 K <±0.05 %	-200°C to 850°C, four-wire connection plus percentage of reading (corresponding to equivalent resistance value)
Drift		±0.01 K/K·ΔT_a	$\Delta T_a = \lvert T_a - 25°C \rvert$; ambient temp: T_a

Optional sensor supply (CANFX/xx-SUPPLY)				
Parameter	Value			Remarks
Configuration options	7 selectable settings			
Output voltage	voltage	current	net power	set globally for all channels of a module
	+2.5 V	580 mA	1.5 W	
	+5.0 V	580 mA	2.9 W	
	+7.5 V	400 mA	3.0 W	
	+10 V	300 mA	3.0 W	
	+12 V	250 mA	3.0 W	
	+15 V	200 mA	3.0 W	
	+24 V	120 mA	2.9 W	
Isolation				
standard	non isolated			output to case (CHASSIS)
optional, upon request	isolated			nominal rating: 50 V, test voltage (10 sec): 300 V
Short-circuit protection	unlimited duration			to output voltage reference ground
Accuracy of output voltage	<0.25% (typ.) / <0.5% (max.) <0.9% (max.)			at terminals, no load 25°C; 2.5 V to 24 V over entire temperature range
Max. capacitive load	>4000 µF >1000 µF >300 µF			2.5 V to 10 V 12 V, 15 V 24 V

Power supply			
Parameter	Value (typ.)	min. / max.	Remarks
Input supply voltage	10 V to 50 V DC		
Power consumption	2.6 W	<3 W	12 V DC, over full temperature range without SUPPLY option (CANFX/xx)
		<7 W	with SUPPLY (CANFX/L-SC16-SUPPLY)
Input supply options	input supply plug (LEMO) CAN-plug (DSUB-9) via clicked module connection		imc CANSAS*flex* or imc BUSDAQ*flex*

Operating conditions		
Parameter	Value	Remarks
Ingress protection class	IP40	only with optional protective cover on top of the locking slider, otherwise IP20
Operating temperature	-40°C to 85°C	internal condensation temporarily allowed

Terminal connections		
Parameter	Value	Remarks
CAN Bus	2x DSUB-9	CAN and supply IN / OUT (male / female)
Supply input	type: LEMO.0B (2-pin)	compatible with LEMO.EGE.0B.302 multicoded 2 notches for optional individually power supply compatible with connectors FGG.0B.302 (Standard) or FGE.0B.302 (E-coded, 48 V)
Module connector	via locking slider	for power supply and networking (CAN) of directly connected modules (Click-mechanism) without further cables

Pass through power limits for directly connected modules (Click-mechanism)		
Parameter	Value	Remarks
Max. Current	8 A	current rating of the module connector
Max. Power	 96 W at 12 V DC 192 W at 24 V DC 384 W at 48 V DC	equivalent pass through power typ. DC vehicle voltage AC/DC power adaptor optional AC/DC adaptor