imc ACC/DSUBM-ICP2I-BNC

Expansion plug for operation of IEPE/ICP sensors

This plug is used to extend imc measurement amplifiers with DSUB-15 sockets with an IEPE conditioning which allows the direct connection of 2 current-fed IEPE/ICP sensors, e.g. IEPE microphones, accelerometers of the type ICP™-DeltaTron®- or PiezoTron® etc.

The IEPE conditioning comprises 4 mA current supply and AC coupling and is channel-individually isolated. This ensures good ground loop suppression and allows operation of transducers that are either grounded or mounted with isolation towards CHASSIS ground.

The expansion plug can be operated in conjunction with isolated and non-isolated voltage and bridge amplifier modules.

It has a TEDS interface for reading out information from the sensor, as long as it supports TEDS (Transducer Electronic Data Sheets according to IEEE 1451.4, Class I, MMI). Thanks to the isolated TEDS interface readout is also supported for grounded transducers as well as with triaxial sensors that have one single common ground lead. Furthermore (and independent from the sensor) the TEDS interface is also used to allow automatic detection of a connected plug by the involved amplifier (supported depending on amplifier type).

IEPE/ICP sensors deliver alternating AC signals which are superimposed on a static offset and decoupled by means of a high-pass ("HP", AC coupling, RC circuit). After connection and activation of the plug, full settling of this AC coupling can take well beyond 10 seconds.

Two variants of the plug are available:

- The **S variant** (slow) achieves minimum cutoff frequency, thus limits the lower bandwidth of the sensor as little as possible. However, the transient response after plugging in (activation) can take longer (>10 seconds).
- The **F variant** (fast) settles faster (approx. 1 second) and therefore does not quite reach the minimum cutoff frequency, but with < 1 Hz is sufficient for very many applications in this form.

Overview of the available variants

Order Code	properties	article no.
• ACC/DSUBM-ICP2I-BNC-S	Slow: low HP cut-off frequency, long settling time	13500293
• ACC/DSUBM-ICP2I-BNC-F	Fast: higher HP cut-off frequency, short settling time	13500294

Highlights

- Functional extension for imc amplifiers with DSUB-15, see *supported amplifier types*
- Robust metal housing with BNC sockets
- Each channel individually isolated (current feed)
- TEDS support (Class I, MMI), see *supported amplifier types*
- Status LEDs to indicate fault conditions (open sensor detection or short circuit)

ACC/DSUBM- Expansion plug vs. dedicated ICP amplifiers

In contrast to dedicated IEPE/ICP mode amplifier types such as QI-4, AUDIO2-4 or ICPU2-8, this extension plug can provide IEPE support for more universal type amplifiers. This added flexibility comes at the expense of a somewhat limited handling comfort.

In particular it is important to be aware that the presence of the plug will dynamically change the properties and capabilities of the associated channel, which needs to be communicated to the host amplifier and the control software. The TEDS functionality is used for this detection process (independent of any sensor specific TEDS data!), which has certain implications for handling and operation.

Basic functionality (ICP-operation) does not require software support and has no associated requirements. However, for support of **sensor TEDS functionality** and for improved **offset performance** it is required that the plug is recognized and supported by the operation software. In particular this involves the activation of an additional digital high pass filter to remove some small residual offset that results from the high impedance AC coupling.

Supported amplifier types (full support vs. basic functionality)

Amplifier resp. Device family		CRFX, CRXT	CRC, CRSL	C-SERIES
UNI2-8	CS-7008-FD	✓✓	✓	✓
DCB2-8	CS-5008-FD	✓✓	✓	✓
B-8	--	✓✓	✓	✓
LV3-8	CS-1208-FD	✓✓	✓	✓
ISO2-8	CS-4108-FD	✗	✗	✗
ISOF-8	--	✗	✗	--
UNI-4	--	✓✓	✗	--
BR2-4	--	✗	✗	--
SC2-32	--	--	✗	--
LV-16	CS-1016-FD	--	✗	✗

✓✓	Software support with variant differentiation (-F/-S), full support of TEDS sensors including sensors of the type DS2431 and a improved offset performance
✓	Software support without variant differentiation (-F/-S), support of TEDS sensors except sensors of the type DS2431 and a improved offset performance
✗	only basic functionality (ICP-operation), no support of TEDS sensors and no improved offset performance
--	amplifier is not part of this device family

The variant differentiation (-S/-F) function is only supported in the CRFX and CRXT device platform:

- Amplifier types with full software support (especially UNI2-8, DCB2-8, B-8, LV3-8, UNI-4) also have matched transient response in the CRFX/CRXT context (digital high pass selected accordingly).
- In the CRC and C-SERIE context, on the other hand, although the lower AC cutoff frequency is determined by the connector variant (-S/-F), the settling time is relatively long for both variants because the additional digital high-pass is fixed at low cutoff frequency in both cases.
- The fast variant therefore does not settle quickly!
- On the other hand, in conjunction with amplifier types that do not offer software support (e.g. ISO2-8, ISOF-8, BR2-4, UNI-4 in CRC context, etc.), the extension plugs are not recognized at all and are therefore not extended with additional digital high-pass. Therefore the behavior is only determined by the analog RC time constants. Thus, both cutoff frequency and settling time are clearly differentiated in the sense of slow/fast, and the fast variant also settles fast. However, the improved zero point accuracy due to the digital high pass is omitted.

Recognition of the Extension plug by the software

The recognition of plug and sensor is triggered differently depending on the device family.

Device family	Abbreviation	Plug recognition	Function
imc CRONOS*compact* imc C-SERIES	CRC CS, CL	The plug recognition and resetting of the channel setting is carried out automatically when preparing the measurement.	
		Sensor data can only be read out via the TEDS function. The plug recognition is also updated.	
imc CRONOS*flex* imc CRONOS-XT	CRFX CRXT	No physical detection upon preparation of measurement (neither identification of the plug nor readout of sensor TEDS data)	
		TEDS readout forces the detection of a currently connected or removed plug. The channel settings are set or reset and displayed accordingly.	

- **Warning:** Before starting a firmware update you have to remove the Extension plug, otherwise the hardware will not start correctly and it will be detected as a "different hardware" and the former amplifier will not be found by the imc software any more.
- Depending on the measuring amplifier used, certain setting options may become invalid and generate error messages when activated (incorrect settings do not cause a hazard).

Technical Specs - ACC/DSUBM-ICP2I-BNC

Parameter	Value typ.	min./ max.	Remarks
Compatible channel types	imc measurement amplifier		with DSUB-15 sockets
Full support			only with CRFX, CRXT device family: software support with variant differentiation (-F/-S), full support of TEDS sensors including sensors of type DS2431 and a improved offset performance
	bridge amplifiers UNI2-8, UNI-4, DCB2-8, B-8 Cx-70xx, Cx-50xx		types with 2 channels per DSUB-15 imc CRONOS device series similar imc C-SERIES devices
	voltage amplifier LV3-8 Cx-12xx		types with 4 channels per DSUB-15: first and third channel used imc CRONOS device series similar imc C-SERIES devices
Basic support			basic ICP operation
	Bridge amplifiers BR2-4		types with 2 channels per DSUB-15 imc CRONOS device series
	Voltage amplifiers ISO2-8, ISOF-8, LV-16, SC2-32 Cx-10xx, Cx-41xx		types with 4 channels per DSUB-15: first and third channel used imc CRONOS device series similar imc C-SERIES devices
Inputs	2		BNC
Input coupling	ICP		current source, 1st order high-pass
Isolation	channel wise isolated ICP-conditioning (current source)		the isolation of each measurement channel depends on the amplifier used (e.g.: ISO2-8 is isolated)
Isolation voltage		≤±50 V	to system ground (CHASSIS) and channel-to channel
Max. input voltage		<±40 V	at BNC input
Constant current feed	4.2 mA	±10%	
Voltage swing	24 V	>22 V	
Current source impedance	340 kΩ	>100 kΩ	in parallel with input impedance of the amplifier
Error indication	LED		open sensor detection and short circuit detection
TEDS	conforming to IEEE 1451.4 Class I MMI supported for selected amplifier and only with CRFX / CRXT		sensor with current feed supported as of imc STUDIO 5.0R1

AC-coupling: High pass cut-off frequency (-3 dB) and typ. settling time - Note (1)			
Parameter	**Value typ.**		**Remarks**
	variant -S "slow"	**variant -F "fast"**	
AC-coupling	235 nF 10 MΩ	235 nF 1 MΩ	RC high pass in the plug The resulting high pass is formed with the additional input impedance of the amplifier (depending on type and measuring range).
Typ. settling time ts	approx. 10 s	approx. 1 s	when connecting and activating
For amplifier types **with software support** imc CRONOS*compact* (CRC), C-SERIES UNI2-8, DCB2-8, LV3-8 imc CRONOS*flex* (CRFX) UNI2-8, DCB2-8, LV3-8	 0.40 Hz 0.12 Hz	 <1 Hz **ts approx. 5 s** <1 Hz	detection, additional digital high pass *long settling time for both variants; for the F variant: settling time: ts = 5 s* time constant of the digital HP specifically matched for S- and F-variant
All other amplifier types **without software support** Depending on input impedance: 10 MΩ 1 MΩ	 0.14 Hz 0.75 Hz	 <1 Hz <1.5 Hz	no detection, without digital high pass e.g. ISO2-8, measurement ranges ≤2 V e.g. ISO2-8, measurement ranges ≥5 V

(1) The cut-off frequency and settling time is determined by the combination of an analog AC coupling (depending also on the amplifier's input impedance) and a digital high-pass (if supported).

The digital highpass is intended to suppress residual offset that can be caused by the amplifiers bias currents in conjunction with the high impedance RC circuit.