SYNTH-8 for imc CRONOS system familiy

8 channel signal generator, synthesizer and realtime PID controller

Data Sheet Version 3.3

This extension module provides 8 analog voltage outputs (DAC) to serve as programmable signal generator, synthesizer and for replay of arbitrary signal sequences. Such waveforms can either interactively defined or loaded as datasets for multiple segments.

Furthermore this module can act as programmable PID controller for realtime closed loop control applications. Its internal and exclusively dedicated processor can operate up to 16 independent and extensively configurable controllers. These operate independently and in parallel and can also be arbitrarily cascaded. Setpoints and inputs to the controllers can be selected from measurement channels, virtual channels and variables of the imc system. The controller outputs can be assigned to the 8 analog outputs in order to drive actuators.

Similar to the field bus interfaces, the SYNTH module is a configuration option: Devices can only be equipped ex-factory at time of order. Exchanging or retrofitting the module to existing systems in the field and by the user is not supported.

The module is available as a one-slot extension to imc CRONONS*compact*, imc CRONOS-SL und –PL, and for extending imc CRONOS*flex* base units.
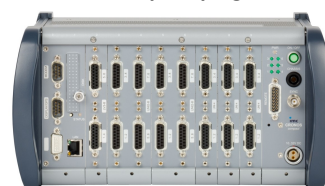
imc CRONOScompact - modular measurement system

imc CRONOS*compact* is a modular and reconfigurable hardware a "rack"-based series of devices available in a variety of housing sizes and device frames. imc CRONOS*compact* (CRC) plug-in-modules can be inserted into the system (CRC-400 / CRC-2000G). This system assembly setup can be adapted quickly and easily.

imc CRONOS*compact* plug-in-modules

Once the modules are plugged into a portable or rack-based housing, they are electrically connected to the CRC-system and are supplied by the system with power. The data storage will be managed by the CRC-system.

imc CRONOS*compact* portable housing

Rack-based modules ("-R") differ from the standard modules only in terms of the front panel's attachment mechanism.

imc CRONOSflex - Frameless expansion, flexible modularity

A imc CRONOS*flex* system is composed of a base unit (CRFX-400 / CRFX-2000G) and one or more modules. imc CRONOS*flex* systems use the EtherCAT standard as "internal" system bus for the connection of the modules with the base unit.

Each base unit can be equipped at factory with up to three Synthesizer modules.

imc CRONOS*flex* distributed system

Overview of available variants

Order code	article number	remarks
CRFX/SYNTH-8	1190143	for installation in a imc CRONOS*flex* base unit, occupying one fieldbus-slot
CRFX/SYNTH-8-ET	11910xx	version in extended temperature range
CRC/SYNTH-8	1170068	for installation in an imc CRONOS*compact* housing, occupying one fieldbus-slot

Order code	article number	remarks
CRC/SYNTH-8-ET	1171042	version in extended temperature range
CRC/SYNTH-8-R	1170131	for installation in an imc CRONOS*compact* RACK
CRC/SYNTH-8-R-ET	1171090	version in extended temperature range
CRPL/SYNTH-8	1080098	for installation in an imc CRONOS-PL housing
CRPL/SYNTH-8-ET	1081063	version in extended temperature range
CRSL/SYNTH-8-D	1180043	for installation in an imc CRONOS-SL housing

Required software version

CRC, CRSL and CRPL

- Supported by imc STUDIO 3.0R4 and imc DEVICES 2.7R3, or higher

CRFX

- Supported by imc STUDIO 5.0R1 and imc DEVICES 2.8R5, or higher

Terminal connections

- 2x DSUB-15 terminals for each 4-channel group

Included accessories for imc CRONOS*flex*, imc CRONOS*compact* and imc CRONOS-SL/-PL

- 2x ACC/DSUBM-SYNTH4

Technical Specs - SYNTH-8

Data Sheet Version 3.3

Outputs, measurement mode, Terminal connection		
Parameter	**Value**	**Remarks**
Outputs	8	
Measurement mode	analog signal output (Synthesizer), real time-controller (PID)	
Terminal connection	2x DSUB-15	4 channels per plug ACC/DSUB(M)-SYNTH-4

Output rate, bandwidth, resolution		
Parameter	**Value**	**Remarks**
Max. output rate (synthesizer mode)	80 kHz	aggregate output rate of all activated channels
Max. output rate with linear interpolation	200 kHz	aggregate output rate
Max. output rate with extended interpolation: Double / triple integral	10 kHz	per channel
Max. output rate (controller mode)	10 kHz	per channel
Analog bandwidth	50 kHz	-3 dB, 3rd order low pass bandwidth of analog driver stage
Resolution	16 Bit	
Total size of memory for all segments	1.000.000 time-stamped samples 4.000.000 equidistant samples	imc format (*.DAT or *.RAW)

Analog output			
Parameter	**Value typ.**	**min. / max.**	**Remarks**
Output voltage range	$\pm$10 V		
Isolation	no galvanic isolation		signal reference: AGND (system ground)
Load current / channel		$\pm$10 mA	25°C
Load current / plug		$\pm$30 mA	current for all four channels of a plug at 25°C
Gain uncertainty		<0.05%	25°C
Gain drift		5 ppm /K	over entire temperature range
Offset	<2 mV	<5 mV	25°C
Offset drift		0.05 mV /K	over entire temperature range
Sensor supply	+5 V (max. 200 mA / plug)		reference "LCOM"
Linearity		2 LSB	

Digital inputs

Parameter	Value	Remarks
Channels	2	isolated, common reference potential ("LCOM")
Input configuration	single-end	common reference: "LCOM"
Input level	TTL / CMOS or 24 V logic	configurable with wire jumper ("LEVEL" - "LCOM") in the connector

Controller functions

Parameter	Value / Function	Remarks
Maximum number of controllers	16	independent and parallel
Set point variable	2 set point channels per controller	selection via control signal; dynamic switching, cross-fade with time constant
Measured process variable (actual value)	2 actual value channels per controller	selection via control signal; dynamic switching, cross-fade with time constant
Cascade control	any number of controllers arbitrarily cascadable: 2 to max. 16 cascade levels	dynamic set point channel switching: from channel to cascaded controller output
Assignment of controllers to analog outputs	2 controllers per analog output (DAC)	selection via control signal dynamic controller output switching, cross-fade with time constant
PID-controller parameter	dynamically alterable during continuous operation	changing PID variables individually or jointly (synchronously) as consistent parameter set
PID parameter sets	2 complete dynamic sets per controller	selection via control signal; dynamic switching, e.g. reference- and working parameter sets
Linearization of controller output variable	configurable characteristic curve	correction of actuator output non-linear characteristics by means of arbitrary loadable data set
Controller output correction	max. 8 per controller	by means of weighted state variables (e.g. measurement channels) or interactive editing
Response to limiting and saturation of controller output	limiting of the integral component	three optional strategies: 1. limit to current I-term 2. reduce by control value 3. limit, if output and I-term have same sign
Controller inhibit	individual controller activation (enable)	via control signal; fade in and out with time constant
Test points (probes)	assignment of internal controller variables to channels	for display and monitoring

Controller parameters	Functions	Remarks
Proportional (P-) component	proportional of current control error	weighting factor proportional gain K_p
Integral (I-) component	integral of control error	integral gain K_i resettable to zero by control signal, reset with time constant, can be limited in response to saturation of control value
Derivative (D-) component	derivative of current error	derivative gain K_d slope of the D-component can be limited by time constant (decay)
Feed forward control	weighted adding of the set point value to the control value	

Time constants

Parameter	Functions	Remarks
Time constant for D-component	low pass filter for the derivative component	decay time
Time constant for resetting the I-component	linear decay of the integral component to zero	after activation of reset control signal
Time constant for activation of closed-loop controller	fade in and out of the resulting control value	after state change of the enable-control signal
Time constant for set point channel switching	smooth transition between alternative set point-channel	after switching of control signal
Time constant for actual value channel switching	smooth transition between alternative channels for measured process variable	after switching of control signal
Time constant for switching of the controller at the DAC	smooth transition between alternative changing controllers assigned to a DAC output	after switching of control signal

Value limits

	Functions	Remarks
Limiting of the control output value	maximum control value minimum control value (independent, asymmetrical)	applies after calculation of all components and of the characteristic curve linearization
Slope limiting	maximum slope of control value	applies after calculation of all components and of the characteristic curve correction linearization
Limiting of the I-component	symmetric (max. / min.)	
Limiting of the D-component	symmetric (max. / min.)	

Errors and changes excepted
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