imc STUDIO 5.0R5

imc STUDIO is the common framework uniting various imc software components (plug-ins) to a modular system. Specific combinations of plug-ins comprise Editions (product packages), each designed for particular applications.

Editions

The following editions are available for imc STUDIO, and each include a certain basic package of plug-ins/ functionalities.

Edition	Order code
imc STUDIO Runtime	imc STUDIO-RUN
imc STUDIO Standard	imc STUDIO-STD
imc STUDIO Professional	imc STUDIO-PRO
imc STUDIO Developer	imc STUDIO-DEV

Additional optional or individually licensable plug-ins can also be integrated.

Each edition is able to apply configurations created with a higher edition, but not to modify them.

Installation varieties

For imc STUDIO there are various installation varieties, parts of whose configuration options can differ substantially.

Installation variety	Required licenses	Description
Default variant: imc STUDIO	One imc STUDIO Edition	imc STUDIO allows configuring of measurement devices, performance of measurements, and monitoring of instantaneous readings. Data can be viewed and edited live at one work station.
For special applications: imc STUDIO Monitor	One imc STUDIO Edition + imc STUDIO Monitor	imc STUDIO Monitor makes it possible to connect with one or more measurement devices during a running measurement, particularly for the purpose of monitoring the instantaneous readings. Data can be viewed and edited live on multiple workstations.

Available plug-ins/components

Below is a table correlating plug-ins and their functions to the individual editions.

Available plug-ins/ components	Description	imc STUDIO Edition			MON*
	●: included ○: optional ◉: subset of full feature set	STD	PRO	DEV	
imc STUDIO	Framework	●	●	●	●
	User administration: Access control, roles and rights management		●	●	●
Setup	Device configuration of imc devices	●	●	●	
	Device configuration of 3rd-party (non-imc) devices (e.g. Video or 3rd-party devices, provided appropriate license available)	○	○	○	
Monitor	Multi-client monitoring and visualization				●
Panel	Display of measurement data	●	●	●	●
Widgets: Standard	Gauges and control elements (basic selection)	●	●	●	●
Widgets: Automotive, Industrial, Designer, Aviation	Extended selection and styles		●	●	●
Project Management	Display of saved measurement data in the Data Browser	●	●	●	
	Projects and Experiment templates		●	●	
Sequencer	Batch generator, workflow automation		●	●	●
Automation (1)	Design of real-time test station automation			●	
Scripting	Integration of custom specific user code incl. accessing external hardware (actuators, lab equipment and devices etc.)			●	●
Third Party Device Interface (2)	Integration of devices from manufacturers (Third Party Devices) into imc STUDIO			○	
Data Processing	User interface for configuring mathematics functions DLL-interface for custom specific processing of data streams	●	●	●	●
imc Inline FAMOS (2)	Real-time analysis on data streams (PC based platform and license)	○	○	○	○
Power Quality	Expansion package for power quality analysis conforming to EN 50160 (IEC 61000-4-30 Class A)	○	○	○	○
Bus Decoder (2)	Extension package for decoding of fieldbus log channels	●	●	●	●
Powertrain Monitoring (2)	Extension package for monitoring powertrains	○	○	○	○
Video	Synchronized video acquisition	○	○	○	
imc SENSORS	Sensor database integration	○	○	○	
Sensors	Expansion package for Setup for setting up imc STUDIO sensors and administering the imc SENSORS sensors.	●	●	●	

*: In the appropriate Edition, the function is included in the installation variety imc STUDIO Monitor
1: Requires additional device based license imc Online FAMOS Professional
2: Available for imc STUDIO 5.0R3

Licensing

License activation is performed using the imc LICENSE Manager. An additional second activation is allowed. Find details in the imc LICENSE Manager documentation.

The Edition imc STUDIO Runtime is a restricted version, free of charge. The trial demo version (offering full functionality of imc STUDIO Developer Edition) is for free as well. Both require activation.

System Requirements

Supported operating systems
Windows 10
Windows 8 / 8.1
Windows 7 (32 bit; recommended: 64 bit)
Windows Vista (32 bit) as of SP1
Windows XP (32 bit) as of SP3

Minimum requirements for the PC [1]	Recommended configuration for the PC [2]
Hyper-threading or Dual Core processor with 2 GHz clock speed	Quad Core processor with 2 GHz clock speed or higher
2 GB RAM / 4 GB RAM for Windows 7 and 8 (64 bit)	3 GB RAM (32 bit) / ≥ 8 GB RAM (64 bit)
10 GB free hard disk space (NTFS format)	10 GB free hard disk space (NTFS format)
For installation of the software via DVD an appropriate drive is needed	For software installation via DVD an appropriate drive is needed
Color graphics (16 bit color depth)	True color graphics (32 bit color depth)
Display resolution 1280 x 768	Display resolution: 1280 x 1024 or more
	64 bit operating system

1 A system with minimum requirements is not adequate for connection with multiple devices and complex design tasks with the imc STUDIO Developer. Use such systems preferably only for data monitoring purposes.

2 The requirements for the PC's configuration increase with the number of devices involved and the scope of the Data Processing-calculations to be performed.

Plug-in imc STUDIO Setup

imc STUDIO Setup is the integrated user interface for the complete configuration of all measurement parameters along with its saving in a system configuration. This user interface can be adapted to individual needs. This provides the ability to link particular settings options to the user's specific level of authorization. Similarly, any interface elements which are not needed can be hidden. As a result, the training required of a user to operate routine experiments is kept to a minimum.

All familiar hardware properties of imc measurement devices are completely supported.

Association of imc STUDIO Setup functions with the imc STUDIO editions

Functionality	Description	imc STUDIO Edition			
	●: included ○: optional ◉: subset of full feature set	RUN	STD	PRO	DEV
Setup	Device configuration of imc devices	●	●	●	●
	Device configuration of 3rd-party (non-imc) devices (e.g. Video or 3rd-party devices, provided appropriate license available)	○	○	○	○
	Customizing of configuration tables		●	●	●
	Combined parameters, meta data, pictures, doc etc.			●	●
Layout designer	Free design of custom Setup menus (GUI)				●
Meta data	Augmenting data with descriptive meta information	◉	◉	●	●
	Defining custom meta data (additional table columns for experiments and channels)			●	●
imc Online FAMOS	Real-time analysis on data streams (device based platform and license)	○	○	○	○
Sensors	Expansion package for Setup for setting up imc STUDIO sensors and administering the imc SENSORS sensors.		●	●	●
imc SENSORS	Sensor database integration	○	○	○	○

Special functions and applications:

- Uniform operating software for imc's Ethernet-compatible measurement devices (see: Supported imc measurement devices)
- Operation of multiple synchronized devices, networked via Ethernet. The maximum device count depends on the computer's memory capacity and on the operating system (64- or 32-bit). System configurations having over 30 devices can be achieved
- Setup automatically recognizes the measurement system's capabilities and offers correspondingly adapted configurations (low training requirements - high measurement reliability)
- Setting up a system configuration ("Experiment") is possible without even having a measurement device physically available ("offline")
- Configures auto-start for autonomous autarkic measurement operation (Diskstart/Autostart)
- Supports sensor recognition by means of TEDS conforming IEEE 1451.4.

Supported imc measurement device groups:	
• imc CRONOS*compact* • imc CRONOS*flex* • imc CRONOS-PL/-SL as of 07/2005	• imc C-SERIES • imc BUSDAQ with serial numbers 13xxxx and higher • imc SPARTAN with serial numbers 13xxxx and higher

Basic functions	Description
Channel settings	• All inputs and outputs of a measurement system can be set using one single user interface (analog inputs/outputs, digital inputs/outputs, field-bus channels, virtual channels, etc.) • Per-channel configuration (e.g. name, sampling interval, measurement duration, input range, characteristic curve correction, filters, and much more.) • Capture of imc CRONOS*flex* channel data in 24-bit • Opening independent curve windows, which are not connected with a Panel page
Data processing	• Data saving can be set for each channel separately • Saving of measured data in a different file format (imc Format Converter,e.g. ASCII, EXCEL and more) • Storage location on the PC and / or the device or on a network server • Each trigger event can be saved to a separate data file • Channels can also be parameterized for internal processing only (data not saved) • CAN Log data in the file format: Vector(CANAlyser) possible
File Manager	• Enhances the Windows Explorer® • Enables copying and deleting of files and folders from the devices internal storage to a PC.
Trigger-Machine	• Either directly started or triggered measurement • Starting and/or stopping by trigger • 48 independent triggers supported • Pre-triggers adjustable • Various definable events (thresholds, time-in-range, signal edges, etc.) • Logical conjunctions of multiple events can form complex trigger conditions • Number of trigger releases freely selectable (multitrigger) • Event-driven digital output

Basic functions	Description
imc Messaging	• Devices having the associated interface (e.g. imc CRONOS*compact*) are able to send text messages in response to particular events. • Available triggering events include all signal transitions in the virtual bits and network bits. • A specific target can be set for each of these message texts. The available message types are email and faxes, and any combination of these. • To send a FAX, a modem supporting the G3-Fax Version 2 or 2.0 is required. The fax machine must also be compatible with one of these two standards. For most modern machines, this should be not present any problems. Emails can be sent either via a modem or via a network interface, if an appropriate server can be reached via the network. With the help of services available through the Internet, it is also possible to forward emails as SMS or fax messages. • If a GSM modem or a GSM mobile is used, the SIM card does not need to be activated.
Balancing and taring function	• Setting of the scaling and balancing performed on a per-channel basis and the results are displayed for the current experiment. • Export / import for adjustment settings for all or selected channels
Sensor Recognition	• Readout of sensor information from TEDS • Adoption of sensor information in the sensor database (imc SENSORS)

Optional functions	Description
Sensor Database imc SENSORS (optional)	For the purpose of editing sensor information, the turnkey, system- independent sensor database imc SENSORS can be integrated. For more information on the sensor database, see the "imc SENSORS" data sheet.
Application-oriented functions (optional)	• Device display (internal display or with hand-held terminal) - Display configuration / Display Editor • Timer start • Autostart / Diskstart • Synchronized measurement with multiple devices. Master device generates a DCF77 or IRIG-B(2) signal. • Real-time clock (DCF 77(1), GPS(1), NTP(2) or IRIG B002(2) radio clock for synchronization of sampling clocks and absolute time) • Support of GPS-receiver for capturing geo-position data • Time zones and switch between daylight saving and standard time • Exchange of display variables via the network • imc Online FAMOS: for device based immediate real-time signal analysis (digital filtering, control commands, closed-loop control, FFT, order-tracking) as well as real-time control. • Synthesizer and PID-controller module • Process vector • Synchronous Tasks, imc Online FAMOS Professional necessary

1 : supported by devices as of group 2 and higher

2 : supported by devices as of group 5 and higher

Supported interfaces	Description
Connection with devices	• Ethernet (LAN) • Modem, external modem for PPP remote control (analog, ISDN, GSM) • WLAN (54 MBit) • Device configuration via FTP • imc REMOTE LinkSecure: Device access by means of imc LINK via secure https access (for imc devices of serial number 14xxx) • imc REMOTE SecureAccess: Access via a secured https-access for imc devices of serial numbers 14xxx and higher. • imc REMOTE Webserver: Provides platform-independent remote access to imc measurement systems (for the purpose of device operation via internet browser) • The connection to the device can optionally be password-protected • Up to 3 (SN 12xxx) or 4 (SN >13000) imc STUDIO Monitor or imc REMOTE plus 3 Microsoft-Explorer connections per device *Example: Device with SN19123 can simultaneously maintain connections with 2 imc STUDIO Monitor, 1 imc REMOTE WebServer and 1 imc REMOTE LinkSecure connections at the same time. Additionally, 3 computers can access the internal data carrier via the Microsoft-Explorer.*
Fieldbusses	• e.g. CAN + protocols, ARINC, LIN, FlexRay, AFDX, XCPoE, J1587, MVB, IPT • imc CANSAS configuration via imc STUDIO Setup, Vector database import (optional)

Data formats	Description
Displayvariable	Float $\pm 10^{30}$
imc Online FAMOS	Local variable: Float $\pm 10^{30}$ PV-variable as Float: $\pm 10^{30}$ PV-variable as Integer: $\pm 2^{31}$

Maximum channel count per device

Type	CRPL/SL/*compact* C-SERIES, SPARTAN, BUSDAQ	CRONOS*flex*
All active channels in total incl. their monitor channels	512	
Active Analog inputs incl. their monitor channels	198	128(2)
Analog inputs (active + passive)	240 (+240 Monitor channels)	
Field-bus channels (active + passive) incl. their monitor channels	1000	
Incremental counter channels	16 (+16 Monitor channels)	
DIO-Ports + DAC-Ports (modules with analog outputs)	16(1)	
Process vector variables	800	

1 : Examples: one DO-16 module correspond to one DIO-Port /
one DI8-DO8-ENC4-DAC4 module correspond to 2 DIO-Ports + 1 DAC-Port

2: Incl. flex-output channels of type DAC-8.

Additional imc STUDIO software options for devices:

Components	Description
imc DEVICES	Device Driver, Firmware and Web-Server. Also: alternative but limited and restricted form of operating software. Comprises a subset of functions such as storage, trigger configuration, messaging etc.
imc Online FAMOS (Professional)	imc Online FAMOS offers a large number of real-time functions for pre-processing. The pre-processing is performed by a digital signal processor (DSP) in the device.
Online class-counting	Extension for imc Online FAMOS: Class-counting and Rainflow counting for fatigue analysis
Online order tracking	Extension for imc Online FAMOS: order tracking analysis of rotating machinery
Vector database interface	Import of *.dbc CAN configuration files
ECU protocols for CAN Interface	Support for complex ECU protocols (CAN-Bus)
imc CANSAS configuration software	Assistant for the configuration of imc CANSAS modules.

Components	Order code	CRPL/SL/ *compact*/*flex*, C-SERIES	SPARTAN, BUSDAQ
imc DEVICES		●	●
imc Online FAMOS	DEV(1)/OFA	●	○
Update of imc Online FAMOS on imc Online FAMOS Professional	DEV(1)/OFA-UP	○	○
Online class-counting	DEV(1)/ONLKLASS	○	○
Online order tracking	DEV(1)/ONORDER	○	○
Vector database linkage	DEV(1)/VEC-DATB	○	○
ECU protocols for CAN Interface	DEV(1)/ECUP	○	○
imc CANSAS configuration software	CAN/CONSOFT	○	○

● : included ○ : optional --- : not available in imc STUDIO

1 : DEV is to be replaced with the device's order code abbreviation.

Plug-in imc STUDIO Panel

The imc STUDIO Panel provides, in addition to the familiar imc curve window, a wide scope of new graphical display possibilities.

It is possible to create report pages for documentation of measurement and analysis results.

Association of imc STUDIO Panel functions with the imc STUDIO editions

Functionality	Description	imc STUDIO Edition			
	●: included ○: optional ◉: subset of full feature set	RUN	STD	PRO	DEV
Panel	Customized visualization of data, including printable pdf reports with measured data		●	●	●
	Individual design and layout, repository		●	●	●
Widgets	Gauges and control elements (basic selection)		●	●	●
	Extended selection and styles (Automotive, Industrial, Designer, Aviation)			●	●
Full screen view	Hidden menus and restricted access (via full screen Panel)			●	●
Data Browser	Management of stored data: browse, search and filter		●	●	●
	Structuring according to meta data		●	●	●
Panel control elements	Interactive launch of actions/commands via Panel control elements (Sequencer commands such as calling Panel pages, applying imc FAMOS functions to channels, ...)		●	●	●
Runtime functionality	Execute but not modify all functions (incl. Widgets, full screen)	●	●	●	●

Functions

	Description
Special functions and applications	• The layout of the report pages can be designed freely and be exported in PDF (report mode). • Compositions of imc STUDIO Widgets in freely configurable pages (dialog mode) • Special imc STUDIO Widgets can be assigned to commands. (e.g. starting measurement or a imc FAMOS analysis)
Basic functions	• Creation of multiple pages in which imc STUDIO Widgets (display and control elements) such as curve windows, potentiometers, scales, state indicators can be positioned in any arrangement. • Synchronized navigation through the data sets in multiple curve windows along one scaled time axis

Data Browser	Description
Display and navigation through data	• Structured according to channel category or sorted by name • Searching and filtering • Navigation by means of tree diagram, selection of either fixed or variable channels for visualization purposes
Current measurement	• Displays all channels and variables belonging to the current measurement
Saved measurements	• Loads and processes saved measurements • Displays all channels and variables belonging to the saved measurements Note: Not available in the installation variety imc STUDIO Monitor
User defined variables	Declaration of variables • Numerical, Text, Data table, Channel, Report channel
Display	• All available channels and variables can be linked with Widgets • Opening of independent curve windows not associated with the Panel • Opens an independent values window with the current values of certain variables
Export / Import	Export variable • individually or all in one file Import variable • imports value to an existing (device or user-defined) variable Load variable • Creates a variable with the properties of the variable to be imported

Widgets	Description
Widgets	• imc Curve window • Standard control elements such as state indicators, edit boxes, numeric inputs, tables, buttons, switches etc. • Extended Widgets are available in four pre-defined styles (Automotive, Industrial, Designer, Aviation) • Control elements such as state indicators, edit boxes, potentiometers, thermometer, bar meters, tables, buttons, switches etc. • A repository is available in which settings for the Widgets can be saved
Skin	• Selection among multiple pre-defined skins for Widgets • Definition of one's own skin possible
Extra functions	• Copying and pasting of Widgets • Loading and saving of curve window configurations • Multi-selection of Widgets and various options for orientation and anchoring • Widgets can be grouped

Panel page	Description
Extra functions	• Loading and saving, copying and pasting of pages • Zooming to optimal possible display • Adapting the page to the respective monitor size • Access rights definable for each page separately

Plug-in imc STUDIO Sequencer

imc STUDIO Sequencer is the plug-in to create an automated measurement workflow. A sequence of actions is designed by means of a graphical Editor in an action table. Alternatively, command sequences can be coupled with events. Global, pre-defined system events as well as user-defined events can be used.

For the purpose of performing analysis by means of imc FAMOS, interaction between imc STUDIO and imc FAMOS is possible. The prerequisite is installation of an imc FAMOS version of 6.1 or higher, as a Runtime, Professional or Enterprise Edition (see Additional imc software products).

Association of imc STUDIO Sequencer functions with the imc STUDIO editions

Functionality	Description	imc STUDIO Edition			
	●: included ○: optional ◉: subset of full feature set	RUN	STD	PRO	DEV
Sequencer	Batch generator, workflow automation			●	●
Runtime functionality	Execute but not modify	●	●	●	●
External applications	Launch external code (DLL) and executables (exe)			●	●
imc FAMOS	Create analysis sequences, extensive post processing	○	○	○	○
imc FAMOS Runtime	Execute automated analysis sequences (instant post processing)		○	○	○

Plug-in imc STUDIO Automation

imc STUDIO Automation allows the implementation of real-time control for test stand automation. Definition and configuration of the control structures and routines is performed on the PC with graphic oriented environment provided by this plug-in. The resulting routines are automatically compiled to code which is directly executed on the measurement device itself. Execution involves the real-time capable platform imc Online FAMOS.

For the purpose of performing analysis by means of imc FAMOS, interaction between imc STUDIO Automation and imc FAMOS is possible. The prerequisite is installation of an imc FAMOS version of 6.1 or higher, as a Runtime, Professional or Enterprise Edition (see Additional imc software products).

Measurement device requirements
The same hardware prerequisite apply as for imc STUDIO Setup.
An extra device option is required: imc Online FAMOS Professional

Association of imc STUDIO Automation functions with the imc STUDIO editions

Functionality	Description	imc STUDIO Edition			
	●: included ○: optional ◉: subset of full feature set	RUN	STD	PRO	DEV
Automation	Design of real-time teststand automation				●
Runtime functionality	Execute but not modify	●	●	●	●
imc FAMOS	Create analysis sequences, extensive post processing	○	○	○	○
imc FAMOS Runtime	Execute automated analysis sequences (instant post processing)		○	○	○

Functions

	Description
Special functions and applications	• Real-time capable process control (state-based control model) • Trace info (tracking of current states during execution) • Limit value monitoring (background supervision of thresholds) • Exception raising and error handling • Graphically oriented definition of the state model (Drag & Drop) • Additional integration of PC interactions (running Sequencer commands, calling Panel pages and applying imc FAMOS functions to channel data) • Quick and easy design of individual user interfaces (GUI) by means of Drag & Drop
Features	• Graphical display of the task flow • Up to five parallel, synchronized tasks can be performed per measurement device, in real-time with selectable cycle intervals of 100 µs to 1 s.

Plug-in imc STUDIO Scripting

The imc STUDIO Scripting is an imc STUDIO plug-in which provides a programming interface (C#, .NET). It comes with the editor SharpDevelop as the development environment.

Along with the ability to freely program routines, Scripting also gives the user access to all major functionalities of imc STUDIO, such as:

- Setup: reading and writing of device and channel configurations,
- Panel: access to the Panel and the Widgets,
- access to the Data Browser: creation, reading and writing of variables,
- processing of channels measurement data with imc FAMOS functions,
- execution of menu actions,
- running Sequencer commands,
- response to events.

The following mechanisms are provided for running scripts:

- as a command
  - in the Sequencer
  - to Widgets
  - in response to events
- in the background
  - linked to a Panel page
  - linked to the experiment or the project

The following script-types are available:

- Script
- Panel script
- Context script
- Type Library script
- Event script
- Third Party Device script

It is possible to export scripts (also in DLL format) and to import them.

Association of imc STUDIO Scripting functions with the imc STUDIO editions

Functionality	Description	imc STUDIO Edition			
	●: included ○: optional ◉: subset of full feature set	RUN	STD	PRO	DEV
Scripting	Integration of custom specific user code incl. accessing external hardware (actuators, lab equipment and devices etc.)				●
Runtime functionality	Execute but not modify scripts	●	●	●	●

Plug-in imc STUDIO Third Party Device Interface

Using the plug-in imc STUDIO Third Party Device Interface,it is possible to integrate devices from other manufacturers (3rd-party devices) into imc STUDIO and run them in the imc STUDIO system.

For this purpose, a C#-script is implemented which models the 3rd-party device's properties. There is a template which simplifies the process of seamlessly integrating the 3rd-party device and its channels into the existing settings menus and setup tables. In particular, this means that these devices/channels appear in the lists of devices and channels in the imc STUDIO Setup. This thus provides uniform operation style and configuration management. The script must additionally implement the interface to the 3rd-party device in the sense of a data driver.

The plug-in 3PDI is specially suited to enhancing a system configuration consisting of imc hardware with supplemental specialty devices and data sources. However, there is also a license available specifically for operation exclusively with 3rd-party devices, without the use of any imc devices.

Besides the developer framework and the licenses to run one's own self-provided scripts, ready-made implementations are also available for purchase.

All runtime licenses (for running 3PDI scripts) can categorically be operated with any edition of imc STUDIO.

A 3rd Party Device Management is available in all imc STUDIO editions, except Runtime.

The advantages of the 3PDI script are:

- integrated and uniform operation via the Setup page
- consistent format for measured data
- synchronized data

Requirements
C# programming skills (for an unmanaged data transfer also C++)
The 3rd-party's interface must be known

Association of imc STUDIO Third Party Device Interface functions with the imc STUDIO editions

Functionality	Description	imc STUDIO Edition			
	●: included ○: optional ◉: subset of full feature set	RUN	STD	PRO	DEV
Run 3PDI scripts	Usage of 3rd-party devices implemented by 3PDI script. Required License: 3PDI (inclusive/exclusive)	○	○	○	○
Edit 3PDI scripts	Create and edit 3PDI scripts				●
3rd Party Device Management	Add 3PDI scripts (the execution may depends on additional licenses)		●	●	●

Already implemented templates and operative third-party devices

Device	Additionally licenses required for running	Description
AudioDevice	none	With the 3rd-party script "AudioDevice", it is possible to the computer's audio devices (such as the microphone input) as a data source.
ChannelLoader	none	The "ChannelLoader"-script enables files in the imc-format to be played back as a signal during a measurement.
FunctionSimulator	imc STUDIO 3PDI-inclusive or exclusive	The template "FunctionSimulator" makes various signal types (sine, cosine, trapezoid, square wave, ...).
SimplePollDevice and SimplePushDevice	imc STUDIO 3PDI-inclusive or exclusive	These 3rd-party scripts are executable templates and can be expanded accordingly.
AgilentInfniiVision DSCO6014L (Digital Scope)	imc STUDIO 3PDI-DigitalScope	Integrates digital oscilloscopes, namely of the series Agilent InfiniiVision DSO 6014L.
fos4x	imc STUDIO 3PDI-fos4x	Supports devices of the manufacturer fos4x for measurements with fiber-optic sensors and optical strain gauges (Fibre Bragg, FBG).

Plug-in imc STUDIO DataProcessing

imc STUDIO DataProcessing is the interface for user-defined DLLs for the purpose of data stream processing. The following plug-ins require Data Processing:

- imc Inline FAMOS
- imc STUDIO PowerQuality
- imc STUDIO BusDecoder
- imc STUDIO Powertrain Monitoring

Association of imc STUDIO DataProcessing functions with the imc STUDIO editions

Functionality	Description	imc STUDIO Edition			
	●: included ○: optional ◉: subset of full feature set	RUN	STD	PRO	DEV
Data Processing	DLL-interface for custom specific processing of data streams	●	●	●	●
Data analysis	Functions package				
imc Inline FAMOS (2)	Real-time analysis on data streams (PC based platform and license)	○	○	○	○
Power Quality	Powergrid analysis (EN 50160, IEC 61000-4-30)	○	○	○	○
Bus Decoder (2)	Extension package for decoding of fieldbus log channels	●	●	●	●
Powertrain Monitoring (2)	Extension package for monitoring powertrains	○	○	○	○

2: Available for imc STUDIO 5.0R3

Functions Package imc Inline FAMOS

Processing and analysis of measured data during a running measurement

imc Inline FAMOS is a functions package for Data Processing.

imc Inline FAMOS enables calculations to be performed on data streams from the measurement currently runnning. The calculations are performed on the PC, taking advantage of the PC's processing power. By contrast, with imc Online FAMOS, the calculations are performed by the device.

Scope of functions:

A number of pre-defined functions are available for calculation purposes. Most of the imc Online FAMOS functions are available in the same way and with the same syntax as in imc Inline FAMOS. There are a few additional functions exclusively in imc Inline FAMOS.

Cross-device calculations:

In contrast to imc Online FAMOS, imc Inline FAMOS provides the ability to apply calculation operations to channels belonging to different devices, if the channels are assigned to Trigger_48 (measurement Start/Stop).

Displaying results:

The results generated are treated as device variables/channels. They are configured on the Setup pages (e.g. Storage) and can be displayed on Panel pages.

Tasks:

Multiple independent, complete calculation sequences (Tasks) can be processed in parallel. The maximum possible scope/amount of these tasks depends on the computational resources required by the functions used, in conjunction with the computational resources available to the PC used.

License:

A license must be purchased in order to use imc Inline FAMOS. In contrast to imc Online FAMOS, this license is not bound to the device used, but rather to the imc STUDIO installation on the PC.

Requirements to the device firmware (imc DEVICES)

If writing DAC with imc Inline FAMOS is required, it is absolutely necessary using firmware version 2.8R7 build 15th August 2015 or newer.

Enhancement Kit

Overview	Description
imc Inline FAMOS ClassCounting	This expansion kit for imc Inline FAMOS contains not only familiar functions for endurance strength analysis but also some very practical new ones. Diverse counting and classification procedures, particularly Rainflow analysis, are available. A license must be purchased in order to use imc Inline FAMOS ClassCounting.

imc Inline FAMOS ClassCounting	Description
Rainflow	The Rainflow matrix and the Residue are calculated on the basis of a loading time function. Numerous options are provided in order to be able to adapt the algorithm to the user's needs.
Standard class-counting procedure	Some class-counting procedures conforming to DIN 45667 (such as level-crossing, Histogram) are available. Particularly helpful are functions for determining one- and two-dimensional histograms. Even one- and two-dimensional revolution class counts can be calculated.
TrueMax procedure	Even in a correctly sampled signal, extreme values do not always coincide with samples. However, for a Rainflow analysis, correct capture of these extremes value is crucial. Simply use the procedure specially designed for this application.

Functions Package Power Quality

Expansion package for power quality analysis conforming to EN 50160 (IEC 61000-4-30 Class A)

imc STUDIO PowerQuality is a function package for Data Processing.

This plug-in allows the calculation of power quality indicators according to EN 50160 (IEC 61000-4-30 Class A). The calculations are performed by the PC on the basis of the currently measured data while measurement proceeds. This utilizes the PCs computation resources.

The following functions are available:

- Single-phase power calculation
- Three-phase power calculation (delta- and star-configuration).
- Saving of the result channels

Each of the functions provides a number of calculated characteristic indicators:

- Power
- RMS
- Frequencies
- Harmonic distortion
- Flicker
- High-frequency components
- Interharmonics

The results returned can be displayed on Panel pages and saved with the associated measurement data.

Functions Package Bus Decoder

Expansion package for decoding Field-bus log channels

imc STUDIO BusDecoder is a package of functions for Data Processing.

This plug-in allows either all or individual measurement channels belonging to a log-channel to be decoded/extracted. A log-channel can be a logged Field-bus communication ("Logfile").

The decoding information which is usually located in separate configuration files (e.g. with CAN in *.dcb) is instead in embedded in the log channel. Thus, the log channel contains all information necessary for decoding. This provides more flexibility and dynamic capability for deciding on targeted extraction of individual channels from the compressed logfile.

The decoding is performed on the basis of the data streams of the measurement currently running on the PC. This utilizes the PC's computation resources.

The following functions are available:

- Decoding of either all or individual channels from a log-channel
- Resampling of the channels
- Saving of the result channels

The results generated can be displayed on Panel pages and saved with the associated measurement data. Subsequent processing by means of imc Inline FAMOS is also possible.

Functions Package Powertrain Monitoring

The component imc STUDIO Powertrain Monitoring has been developed in close cooperation with the company GfM (Gesellschaft für Maschinendiagnose mbH), experts in machine and bearing diagnostics.

It is dedicated to diagnosis of powertrains. The powertrains can consist of motors, shift gearboxes and engines as well as devices for braking. The diagnosis can be used in field scenarios, test rigs or end of line tests in production.

Powertrain Monitoring offers two different kinds of diagnosis of vibrations: a Base diagnosis on the basis of characteristic values and a Advanced Diagnosis on the basis of a frequency selective search of kinematic pattern.

A configuration for a specific gear type is set up in the imc STUDIO project, from where it can be distributed to different test locations.The actual application is run in the experiment by assigning the inputs to the physical measurement channels in accordance with the configuration selected. This makes it possible to use the same configuration on different measurement systems if multiple test locations are driven with the same powertrain type.

For Powertrain Monitoring, an extra license is required, which is available from imc Meßsysteme GmbH. It can be combined and run with various base-editions of imc STUDIO.

Plug-in imc STUDIO Project Management

imc STUDIO Project Management administers all files accruing from both the configuration and data acquisition processes. A database is created in which all configurations (experiments) and measured data are stored. Settings applicable across the experiment boundaries, as well as the experiments themselves are saved in projects. These associated settings are available for all experiments belonging to the respective project. Creating multiple projects allows a clear structure to be maintained.

Basic functions:

- Management of multiple projects and their respective settings
- Export/Import of projects or selected experiments
- Creation of multiple experiment templates with arbitrary default settings

Association of imc STUDIO Project Management functions with the imc STUDIO editions

Functionality	Description	imc STUDIO Edition			
	●: included ○: optional ◉: subset of full feature set	RUN	STD	PRO	DEV
Project management	Experiment templates			●	●
	Administration and grouping of experiments within projects			●	●
	Display of meta data while selecting experiments		●	●	●
	Measurement storage area		●	●	●

Functions

	Description
Basic functions	• Management of multiple projects and their respective settings • Export/Import of projects or selected experiments • Creation of multiple experiment templates with arbitrary default settings • Display of meta data while selecting experiments
Measurements	• Enables displaying of saved measurements in the Data Browser • Measurement storage area: Allows the measurements to be saved in varying (including variable-dependent) folders.

Plug-in imc STUDIO Video

imc STUDIO Video is the imc STUDIO plug-in for capture and processing of video data. Simultaneously and in synchronization with data capture by imc measurement devices, video data from cameras are recorded. The cameras must be connected to the operating PC on which imc STUDIO is running.

The achievable data rate depends on the PC's performance.

Association of imc STUDIO Video functions with the imc STUDIO editions

Functionality	Description	imc STUDIO Edition			
	●: included ○: optional ◉: subset of full feature set	RUN	STD	PRO	DEV
Video	Synchronized video acquisition	○	○	○	○

Specifications and Notes

Data capture:

- Two measurement channels per camera are available simultaneously: the main channel and the monitor channel. Among other things, this means that you may apply different settings for the sampling rate and triggering.
- Main channel for high-speed capture and storage, e.g. for triggered snapshots.
- Duplicated monitor channel at low-speed sampling rates, e.g. for untriggered, continuous long-term measurements.

Visualization:

- A video-Widget (Window) is provided to display video data on Panel pages.
- Multiple such video windows can be placed on the pages of the Panel.
- Each video window can be assigned to either a camera's main or monitor channel.
- In the video window, data are displayed even before release of the trigger.

Trigger:

- The main- and monitor channels can each be assigned to different imc measurement device triggers.
- The imc measurement device's triggers are also the triggers for the camera. This means that video channels are triggered at the same time as the associated imc measurement device channels.
- Pre-trigger: As for the imc measurement device channels, it is also possible to configure pretriggers for video channels. This means that the data recorded can also include images relating to situations prior to the trigger events.
- Pre-trigger duration: 0 sec to 10 minutes.

Synchronization:

- Automatic synchronization of the video- and measurement data.
- The achievable accuracy depends on the workload of the entire system.
  Up to dt = [1 frame duration + 20 ms] is achievable.
- The device must be connected with the PC by an Ethernet line of at least a 100 MBit/s , with a maximum of 1 hub or switch in between. The connection must remain intact for the duration of the entire measurement.

Advisory notes:

- For stable and reliable operation we recommend the use of tested and approved camera models and selected software drivers according to the tables: *Supported Cameras*. imc can only grant support for these combinations listed.
- Systems with cameras from different manufacturers are not recommended, since the drivers could also interact uncontrollably.
- For maximum cable length between the control PC and camera, please refer to the respective technical specs for the camera.

Data throughput / frame rate:

- The data transfer rate is specified as the frame rate (typically 60 fps)
- The frame rate is based on pictures of the size 640 * 480 pixels with 1 Byte per Pixel in Bayer encoding, meaning 300 kByte per frame. This results in 17.5 MByte per second being continually written to the data storage medium.
- With the computer equipped accordingly, in Bayer format up to 100 fps can be achieved for 640 * 480 pixels or 200 fps for 320 * 240 pixels.
- The data transfer rate stated is aggregate. When multiple cameras are used, they split the transfer rate. Thus, a camera with 60 fps has about the same transfer volume as two cameras with 30 fps apiece. One camera at full resolution of 640 x 480 generates about the same data volume as four cameras with 320 x 240 resolution.
- With other encoding (such as RGB instead of Bayer), the data volume is increased threefold. This means the achievable frame rate is reduced to one third.
- With triggered data recording (all video channels not assigned to any 1-Trigger), the achievable frame rate is cut in half due to higher demands on the system made by the circular buffer memory used.

Prerequisites for achieving maximum frame rate:

- Windows 7 operating system. The performance of XP and Vista is lower in certain areas.
- Hard drives: Solid State Disk (SSD) or 3.5” SATA hard drives (at least 5400 revolutions per minute) configured as Raid 0 [1]. Please note that 2.5” hard drives are much slower. Particularly in notebooks, slower hard drives are often installed.
- The data carrier may only be filled to a maximum of 70%. Note that writing to a harddisk that is almost full results in significantly reduced writing speed.
- The data carrier may not be fragmented. Note that high writing speed is only achieved if the write head is not forced to excessive displacements.
- Hard drive controller: This must allow data throughput in write mode. Please note that during measurement operation mode, not only video files have to be written, but other data as well!
- Processor: Quadcore with 2.4 GHz (or in case of using Intel I7, two processor cores should be sufficient).
- Interface to camera: 1 GBit Ethernet, Firewire A or B or USB as of Version 2.0.
- No virus scanner for video files.
- No backup tool (or synchronization tool) in use during the measurement.
- No additional programs running on the computer. Also services such as hard drive defragmentation or file indexing may not be running during measurement.

[1] A RAID system consists of multiple hard drives connected together in Stripe-Mode (RAID 0). This increases the capacity as well as the data throughput. It is also possible to connect more than two hard drives, but eventually the hard drive controller imposes limits on the data throughput.

Crucial parameters for optimum frame rate performance:

- The maximum frame rate is determined by the camera's properties
- The performance capacity of the interface to the camera, e.g. 400 MBit/s for Firewire A
- The hard drive controller's and its PC interface and driver
- Processor and mainboard chip set
- The hard drive's maximum writing speed
- Compression

Supported Cameras

Supported and tested cameras:

- Connector type: 1394-Fire Wire A

Camera		Driver		Operating system	Limitations / Remarks
Manufac.	Model	Manufac.	Version		
Imaging Source	DFK 21BF04	Imaging Source	4.1.1.1	Win XP/ Win Vista/ Win 7	
	DFK 31AF03-Z2			Win 7	
Allied Vision	Marlin F-033C	Allied Vision		Win XP/ Win Vista/ Win 7	Few camera settings available

- Connector type: 1394-Fire Wire B (A compatible)

Camera		Driver		Operating system	Limitations / Remarks
Manufac.	Model	Manufac.	Version		
Basler	Scout scA640-120fc	Basler		Win XP Win Vista Win 7	No recognition of plugging/unplugging In order to achieve the full frame rate with the camera, it is necessary to increase the camera's packet size to 8192. This is done under the heading Transport-Layer in the camera Properties, by means of the manufacturer-specific application (tool). Please contact your camera manufacturer for detailed information on the camera settings and other settings.

- Connector type: Gigabit-Ethernet

Camera		Driver		Operating system	Limitations / Remarks
Manufac.	Model	Manufac.	Version		
Imaging Source	DFK 21BG04.H	Imaging Source	1.0.0.513	Win XP/ Win Vista/ Win 7/	No recognition of plugging/unplugging Exposure automatically regulated in response to frame rate
Basler	Scout scA640-120gc	Basler		Win XP/ Win 7	No hot-plug recognition
	Ace acA640-90g				Sensor: 1/3" Sony ICX424 PoE (Power over Ethernet) No hot-plug recognition
	Ace acA640-100g				Sensor: 1/4" Sony ICX618 PoE (Power over Ethernet) No hot-plug recognition
	Ace acA645-100g			Win 7	Sensor: 1/2" Sony ICX414 PoE (Power over Ethernet) No hot-plug recognition
Flir	A35 f = 9mm with SC	Flir	1.9.1.0	Win 7	Infrared camera To operate the camera, the eBus SDK (v4.0.6) is required. You can obtain it from the imc Hotline. The color map's colors (heatmaps) are not calibrated to the temperatures. This means that it is not possible to deduce the exact temperature from the color.

- Connector type: WLAN

Camera		Driver		Operating system	Limitations / Remarks
Manufac.	Model	Manufac.	Version		
GoPro	Hero 4 Black	-	-	Win 7	Only one GoPro camera at a time can be used in an experiment. In order to operate the camera, a special driver package is required. This driver package can be obtained from the imc Hotline. The video recordings are not synchronized to the measurement readings. However, Videodata can be retroactively synchronized with the help of imc FAMOS,for example. No pretriggering is possible for video recording with the GoPro. Recordings are not automatically saved to the imc STUDIO database. The preview of GoPro is delayed by how much depends on the network. At some resolutions, no preview is possible (see GoPro user's manual).

- Connector type: USB 2.0

Camera		Driver		Operating system	Limitations / Remarks
Manufac.	Model	Manufac.	Version		
Microsoft	LifeCam Cinema	Microsoft	3.20.240.0 (XP)	Win XP/ Win Vista/ Win 7/	M-JPEG compression
	LifeCam HD-6000 for Business		6.1.7600. 16543	Win 7	
	LifeCam Studio		6.1.7600. 16543		
Logitech	HD Webcam C615	Microsoft [3]	6.1.7601. 17514	Win 7	M-JPEG compression
	QuickCam Pro 9000 Webcam		5.1.2600. 2180 (XP)	Win XP/ Win Vista/ Win 7	M-JPEG compression Tilt / pan listed but no functionality
	C600 Webcam		6.1.7600. 16385 (W7)	Win 7	M-JPEG compression

[3] Please use the supported and tested Microsoft driver, do not use the Logitech driver

Frame Grabber and Compression

Frame grabber-Driver table

Frame grabber		Connector type	Driver		Operating system	Limitations / Remarks
Manufac.	Type		Manufac.	Version		
Imaging Source[4]	DFG/ USB2-it	USB 2.0/ PCI/ PCIe	Imaging Source	1.1.0.3	Win 7	Video format with color min. 2 Byte per Pixel (compression recommended)
Enciris Technologies	LT-102-PCIE	PCIe	Enciris	1.40	Win 7	Hardware Video compression WV1 (H264 similar)

[4] product type is not available any more

Compression table

Manufac.	Type	Version	Operating system	Limitations / Remarks
Pegasus Imaging	PICVideo (Motion-JPEG)	3	Win 7	Note: external license necessary (demo version is not enough) as default a compression of ca. 1:12 will be set

imc STUDIO Monitor

The imc STUDIO Monitor plug-in makes it possible to connect with one or more measurement devices during a running measurement, particularly for the purpose of observing the current measurement data. Data can be viewed and edited live on multiple workstations.

Measurement device requirements
The same hardware prerequisite apply as for imc STUDIO Setup.
For the purpose of connecting with imc STUDIO Monitor, the devices must additionally have at least 32 MB of internal device memory available.

imc STUDIO Monitor is an independent installation variety of imc STUDIO. This means it is installed and started as a separate application. For Monitor, separate licensing is required accordingly (an edition of imc STUDIO + imc STUDIO Monitor).

imc STUDIO Monitor has a different scope of functions than imc STUDIO. The following functions/ components are categorically not available (no matter which edition):

Available plug-ins/ components	Description
Setup	Device configuration of imc devices
	Device configuration of 3rd-party (non-imc) devices (e.g. Video or 3rd-party devices, provided appropriate license available)
Project Management	Display of saved measurement data in the Data Browser
	Projects and Experiment templates
Automation (1)	Design of real-time test station automation
Third Party Device Interface (2)	Integration of devices from manufacturers (Third Party Devices) into imc STUDIO
Video	Synchronized video acquisition
imc SENSORS	Sensor database integration
Sensors	Expansion package for Setup for setting up imc STUDIO sensors and administering the imc SENSORS sensors.

Association of imc STUDIO Monitor functions with the imc STUDIO editions

Functionality	Description	imc STUDIO Edition			
	●: included ○: optional ◉: subset of full feature set	RUN	STD	PRO	DEV
Monitor	Multi-client monitoring and visualization		●	●	●
Runtime functionality	Execute but not modify	●	●	●	●

Functions

Basic functions	Description
Accessing of device	At most, • three imc STUDIO Monitor PCs can be directly connected with one device (SN 12xxx), or • four imc STUDIO Monitor PCs can be directly connected with one device (as of SN 13xxx).
Channel settings	Settings per channel/variable • Activate visibility (monitors) • circular buffer memory for the visualization

Storage settings	Settings for all visualized channels
	• Activate data saving
	• Folder designation
	  • Date and time
	  • Consecutive numbering
	• Interval saving (optional with a selected maximum count)

Writing rights	Writing to device variables optionally possible

Additional imc Software Products (optional)

Product	Description
imc FAMOS	Some imc STUDIO plug-ins (Automation, Sequencer, Panel) are able to integrate imc FAMOS for data analysis purposes (executing sequences). imc FAMOS is a imc software for complex analysis, display and presentation of signals on the PC ("offline"): www.imcfamos.com imc FAMOS must be separately purchased and licensed for the PC. Details on imc FAMOS are available in the software documentation. To execute ready to run sequences for analysis in imc STUDIO, an installation of imc FAMOS version of 6.1 or higher, as a Runtime, Professional or Enterprise Edition is required.
imc Online FAMOS Professional	Some imc STUDIO plug-ins require devices having imc Online FAMOS Professional. imc Online FAMOS, or its Professional version, is the software which processes data within the measurement device ("online"). imc Online FAMOS Professional must be purchased and licensed along with the device.
imc SENSORS	imc STUDIO Setup can use the imc SENSORS database. imc SENSORS is a ready-to-go, universal database application for administering and editing sensor information. In particular, the entries in the sensor's technical data sheet as well as its calibration values are processed and managed. Along with these values for smart sensors (TEDS) defined in IEEE 1451.4, selections of additional sensor properties can be entered. The prerequisite is installation of an imc SENSORS version of 1.3R3 or higher.