CAL-PM
DATA SHEET

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CAL-PM

CAL-PM device is for permanent monitoring and PLC control system for compressed air applications. It covers all fields such as Remote Energy Management Systems, Data logger and Compressed Air Control System. System is doing real time access to data from any web browser for end user and their service partner.

Benefits:

> Save on energy costs ;
> Improve your energy efficiency ;
> Save your time and improve the organization ;
> Distribute costs in relation to actual consumption ;
> Improve the reliability of your equipment ;
> Improve forecast of energy consumption ;
> Improve your environmental image ;
> Improve the investment process (energy equipment) ;
> **ISO 50001:2011,** *Energy management systems* compliant.

Features:

> Three in one - measuring, remote monitoring / alarming / reporting system and PLC control system for compressed air applications;
> WEB based application CALMS;
> Measuring data logger for compressed air system detail analysis;
> Energy management – Specific Power, M/T, CUSUM analysis;
> Detail Analysis of Compressed Air System with Report - done after customer confirmation, based on Auto Generated Warning of poor efficiency with potential savings calculation compared to best in class efficiency from CALMS knowledge data base;
> Expandable;
> Secure internet connection between CAL-PM and CALMS;
> Multiple data export options (CSV, XML), and easy online printing;
> Built-in web browser;
> Automated Monthly Reports send on emails;
> Alarms & Warnings Email or SMS notification with stored Analysis data;
> Multiple access for end users and experienced CA service providers;
> Easy to use interface;
> Remote software upgrade capability;
> Dual system PLC and PC Windows CE operating system;
> Ethernet and EtherCAT;
> GPRS cellular modem 3G/4G;
> No need for local operator panels – access from anywhere with tablet or smartphone;
> Industrial design;
> Dimensions: 300mm x 200mm x 160mm;
> Wall mounting bracket

CALMS - Process diagram
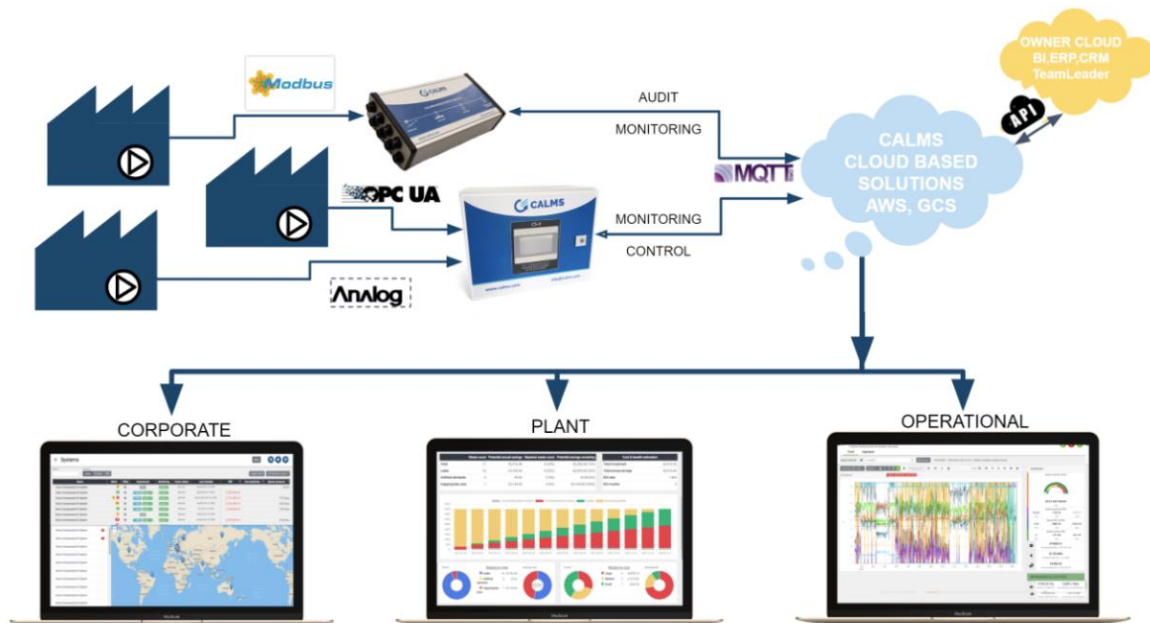
CAL-PM base is placed in air compressor room. CAL-PM is connected to compressors and other measurement equipment. All analog and digital signals will be sent to the CALMS virtual cloud, if communication is established. An antenna must be connected, so CALMS – PM can communicate with virtual cloud. If there is a communication, all data will be shown on CALMS application, where you can analyze, control, monitor your compressed air system.

All functionalities in one single device-data logger:

- ✓ Monitoring ;
- ✓ Energy monitoring control system-EMCS;
- ✓ Electricity consumption measurement (kWh);
- ✓ Direct data interchange / communication (Ethernet as standard or GPRS as options);
- ✓ Concentrator (analog inputs / outputs):
  - • Connection of additional meters and sensors
  - • Tracking of process values
  - • Remote control of the devices
- ✓ Detail Analysis through service partner;
- ✓ Equipment performance analysis and alarming.

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Compressed Air Energy Monitoring System:

> CALMS PM Remote monitoring system for compressed air systems for 1-16 compressors;
> Data logging with 5 sec sampling rate;
> Permanent monitoring system stores data on internal SD card and transmits data to the cloud server through cellular 4G LTE communication or via Ethernet network connection;
> Data can be access on app.calms.com. Application is designed for total control over compressed air, with build in reporting, alarming and detail analysis for CAS service provider and experts;
> Complete parameterization and setup can be done on Internet web application app.calms.com;
> Control system EMCS is optional software add-on;
> No need for local operator panel - complete parameterization and monitoring is done via Internet, on cloud app with laptop or tablet;
> Detail analysis of Compressed Air System with detail report, done after customer confirmation based on auto generated warning of poor efficiency with potential savings calculation compared to best in class efficiency from CALMS Knowledge Database.
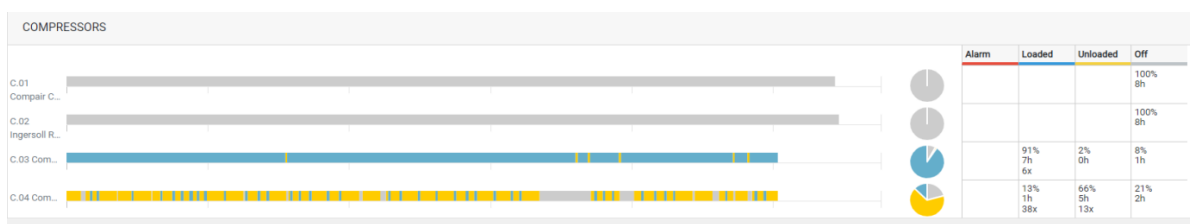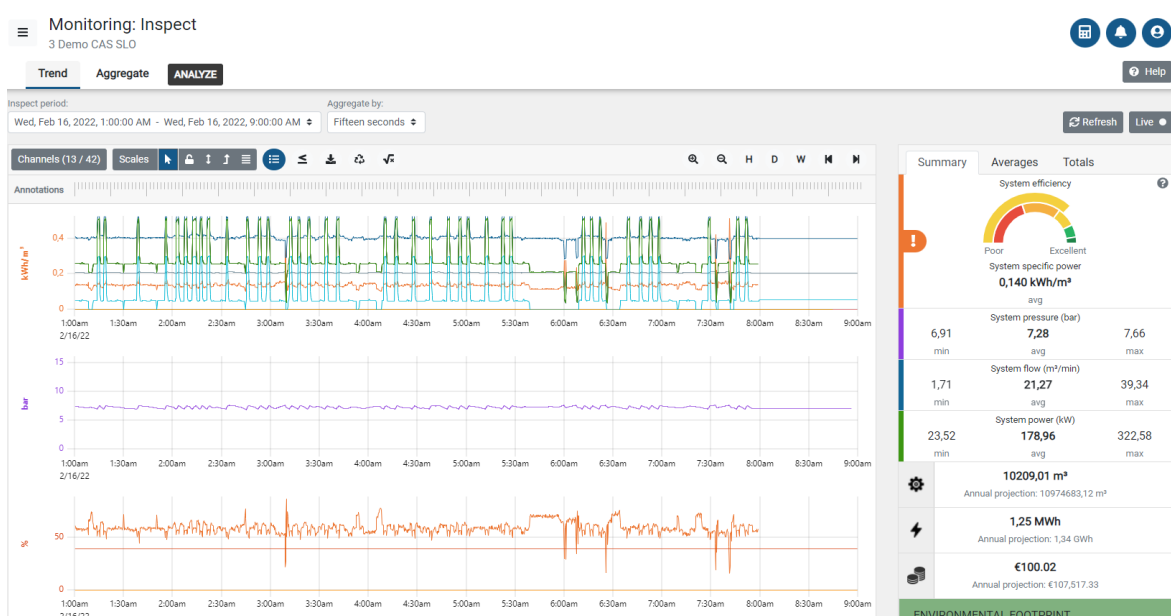

View of CALMS monitoring page

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Energy Management Control System – compressor sequencer option:

EMCS (Energy Management Control System) is an extra option and it is capable of controlling up to 16 compressors. The compressors may be fixed speed (ON/OFF) or variable speed (VSD). To activate EMCS function for regulation customer has to purchase this option. After purchasing the additional pages on the HMI are unlocked and further options and settings are accessible. Control System (EMCS) has to know which compressor is available for control and which is not.

Each compressor has four main states:
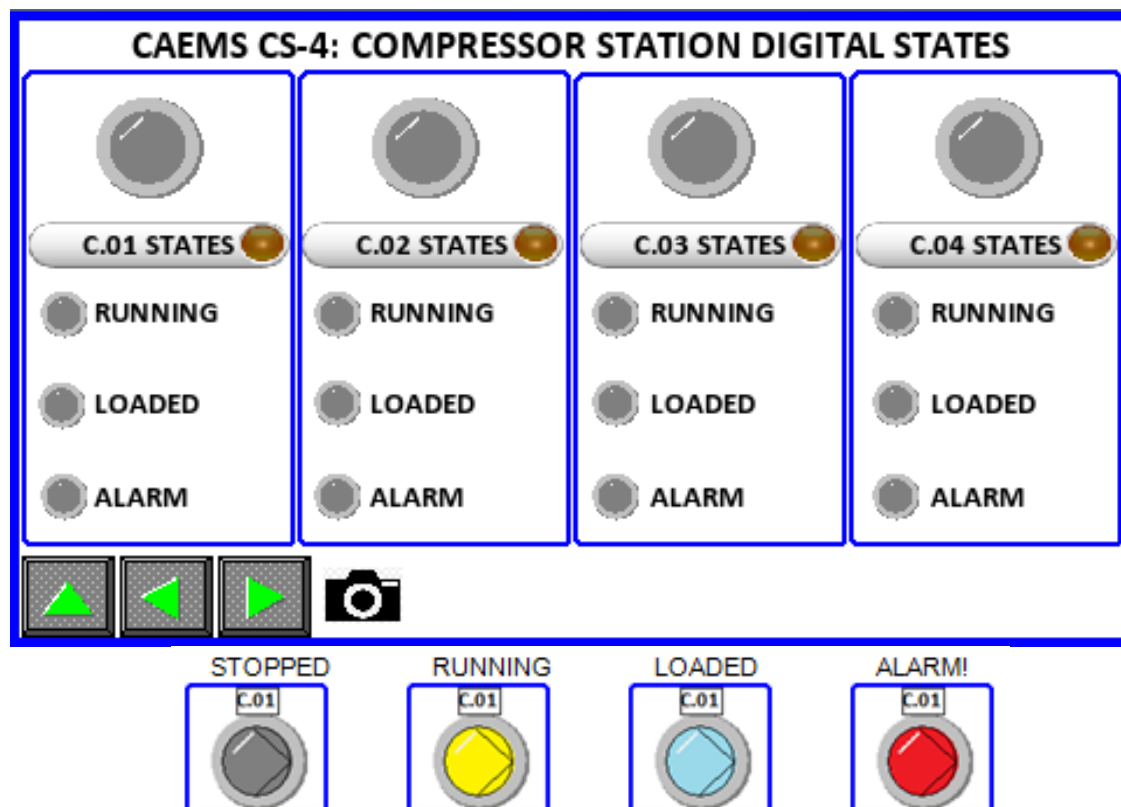
View of EMCS software

Specifications:

CALMS-PM is hardware that connects compressor system to Internet based application for energy management.

For compressor system you need base module **CAL-PM-x-BASE** and for each compressor you need **Compressor Interface Module kit CAL-C-ON/OFF** or **CAL-C-VSD** (depends on the type of the compressor; ON/OFF or VSD).

NOTE: CALMS CAL-PM system is expandable from CAL-PM-2, CAL-PM-4, CAL-PM-8 and even CAL-PM-16.

If you increase number of compressors from 2 to 3 you can only install new compressor module CAL-C-xx and change CALMS from CAL-PM-2 to CAL-PM-4.

You can also expand system with many options like additional new sensors, more analog and digital inputs…

CALMS CAL-PM is also prepared as PLC Control System for compressors (as simple add on function).

Base module:

Description	CAL-PM-2	CAL-PM-4	CAL-PM-8	CAL-PM-16
S-PLC Controller	Processor 32bit, 400MHz flash memory micro SD 1GB, internal memory 64MB RAM	Processor 32bit, 400MHz flash memory micro SD 1GB, internal memory 64MB RAM	Processor ARM Cortex, 1GHz flash memory micro SD 1GB, internal memory 1 GB DDR3 RAM	Processor ARM Cortex, 1GHz flash memory micro SD 1GB, internal memory 1 GB DDR3 RAM
Protocol	Real-time Ethernet, ADS TCP, Modbus TCP, TCP/IP, UDP/IP, EAP	Real-time Ethernet, ADS TCP, Modbus TCP, TCP/IP, UDP/IP, EAP	Real-time Ethernet, ADS TCP, Modbus TCP,TCP/IP, UDP/IP, EAP	Real-time Ethernet, ADS TCP, Modbus TCP, TCP/IP, UDP/IP, EAP
Interfaces	3x Ethernet 10/100Mbit/s (2x network adapter)	3x Ethernet 10/100Mbit/s (2x network adapter)	2x Ethernet 10/100Mbit/s 4x USB 2.0, 1x optional interface	2x Ethernet 10/100Mbit/s 4x USB 2.0, 1x optional interface
UPS	1-second UPS (for 1 MB persistent data)	1-second UPS (for 1 MB persistent data)	1-second UPS (for 1 MB persistent data)	1-second UPS (for 1 MB persistent data)
Possible number of compressors	2	4	8	16
WEB Management	Yes	Yes	Yes	Yes
EMCS, CFC, SOV	Yes (optional)	Yes (optional)	Yes (optional)	Yes (optional)
Visualization	4,3'' Touch HMI	4,3'' Touch HMI	7'' Touch HMI	7'' Touch HMI
Logging interval	5sec	5sec	5sec	5sec
CS to internet upload interval	5min	5min	5min	5min
Data storage	SD 512MB	SD 512MB	SD 1GB	SD 1GB
Cloud connection	3G/4G	3G/4G	3G/4G	3G/4G
Operating range	0-50°C 32-131F	0-50°C 32-131F	0-50°C 32-131F	0-50°C 32-131F
Power supply	100 - 240VAC 50-60Hz	100 - 240VAC 50-60Hz	100 - 240VAC 50-60Hz	100- 240VAC 50-60Hz
Size	H210 x W300 x L380 [mm] H8,26 x W11,81 x L14,96 [inches]	H210 x W300 x L380 [mm] H8,26 x W11,81 x L14,96 [inches]	H210 x W300 x L380 [mm] H8,26 x W11,81 x L14,96 [inches]	H210 x W300 x L380 [mm] H8,26 x W11,81 x L14,96 [inches]
Materials	Enclosure: Steel cabinet, Cable Entry ICOTEK	Enclosure: Steel cabinet, Cable Entry ICOTEK	Enclosure: Steel cabinet, Cable Entry ICOTEK	Enclosure: Steel cabinet, Cable Entry ICOTEK
Mounting	Mast or wall mounting	Mast or wall mounting	Mast or wall mounting	Mast or wall mounting
EMC	EN 61000-6-2/EN 61000-6 4	EN 61000-6-2/EN 61000-6-4	EN 61000-6-2/EN 61000-6-4	EN 61000-6-2/EN 61000-6-4
Class	IP54	IP54	IP54	IP54
Approvals	CE	CE	CE	CE
Digital inputs*	12	24	40	72
Analog inputs**	4	8	8	8
Digital outputs	12	20	36	68
Analog outputs	N/A	N/A	N/A	N/A

* with maximum CAL-C modules installed.
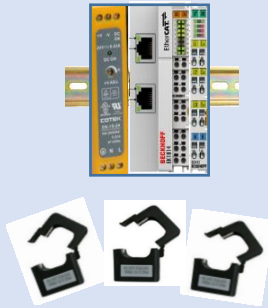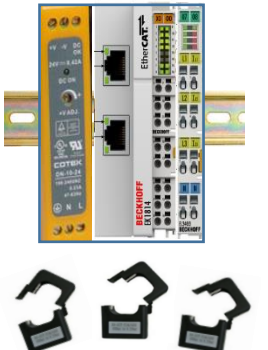** depends on number of VSD compressors (AO only in CS-Cxx-VSD modules).

Inputs/Outputs	Range	Resolution
Analog inputs	4-20mA	12-bit
Analog outputs (only in CAL-C-VSD)	4-20mA	12-bit
Digital inputs	24VDC (1-wire connection)	
Digital outputs	Relay Rated for 24VDC and max. 0.5A	
Power inputs (installed in CAL-C-xx)	Current, voltage, effective power, apparent power, reactive power, frequency, energy, efficiency factor (cosφ)… Max 500VAC 3~ (ULX-N: max. 288VAC)	

Compressor modules:

Description	CAL-C-ON/OFF	CAL-C-VSD
Coupler	Module coupler for E-bus terminals with integrated digital I/O's: 4 digital inputs 24VDC, filter 3.0ms, type 3 4 digital outputs 24VDC, 0.5A, 1-wire system E-bus power supply, current: max.1A	Module coupler for E-bus terminals with integrated digital I/O's: 4 digital inputs 24VDC, filter 3.0ms, type 3 4 digital outputs 24VDC, 0.5A, 1-wire system E-bus power supply, current max.1A
Protocol	EtherCAT (to base station)	EtherCAT (for base station)
Bus Interface	2x RJ 45 switched EtherCAT module	2x RJ 45 switched EtherCAT module
Mounted in	ON/OFF compressors	VSD compressors
Power supply	24VDC, 1A, 24W	24VDC, 1A, 24W
Analog outputs	None	2x
Size	H10 x W8 x L15 [cm] H3.9 x W3.1 x L5.8 [inches]	H10 x W8 x L15 [cm] H3.9 x W3.1 x L5.8 [inches]
Weight	0.3 kg (0.6 lbs)	0.3 kg (0.6 lbs)
Materials	Enclosure: PBT Polycarbonate, ABS plastic	Enclosure: PBT Polycarbonate, ABS plastic
Mounting	DIN Rail mounting in compressor cabinet	DIN Rial mounting in compressors cabinet
EMC	EN 61000-6-2/EN 61000-6-4	EN 61000-6-2/EN 61000-6-4
Class	IP23	IP23
Approvals	CE	CE
Power analyzer	3-phase power measurment terminal, max. 500VAC 3~, max. 5A, via measuring current transformers xA/5A Accuracy: ANSI 12.20, 1% accuracy, IEC 62053-22 Class 1S Compatible with CT's from 5 to 32000A, UL listed, CE, ANSI C12.20 3 pcs current transformer coils 0-500A / 5A as standard (as option available also split core CT and different sizes)	3-phase power measurment terminal, max. 500VAC 3~, max. 5A, via measuring current transformers xA/5A Accuracy: ANSI 12.20, 1% accuracy, IEC 62053-22 Class 1S Compatible with CT's from 5 to 32000A, UL listed, CE, ANSI C12.20 3 pcs current transformer coils 0-500A / 5A as standard (as option available also split core CT and different sizes)

Order codes and information:

Order code:		Description:	
CAL-PM-2		Base module PM-2 for **permanent monitoring and control (optional)**; Wall mounted Cabinet with Embedded PC-PLC system with 4G & Ethernet connection **for up to 2 compressors** - without CPM-C Compressor	Number of compressors : 2 Measuring Data logger Inputs: 18 DI-Digital Inputs: 12 AI-Analog Inputs 4-20 mA: 4 DO-Digital outputs: 12 CI-Calculated Inputs: 8 PI-Power measuring Input: 2
CAL-PM-4		Base module PM-4 for **permanent monitoring and control (optional)**; Wall mounted Cabinet with Embedded PC-PLC system with LTE 4G & Ethernet connection **for up to 4 compressors** - without CPM-C Compressor Interface modules;	Max. Number of compressors: 4 Measuring Data logger Inputs: 32 DI-Digital Inputs: 20 AI-Analog Inputs 4-20 mA: 8 DO-Digital outputs: 20 CI-Calculated Inputs: 16 PI-Power measuring Input: 4
CAL-PM-8		Base module PM-8 **for permanent monitoring and control (optional)**; Wall mounted Cabinet with Embedded PC-PLC system with LTE 4G & Ethernet connection for **up to 8 compressors** - without CPM-C Compressor Interface modules;	Max Number of compressors: 8 DI-Digital Inputs: 36 AI-Analog Inputs 4-20 mA: 8 DO-Digital outputs: 36 CI-Calculated Inputs: 32 PI-Power measuring Input: 8
CAL-PM-16		Base module PM-16 **for permanent monitoring and control (optional)**; Wall mounted Cabinet with Embedded PC-PLC system with LTE 4G & Ethernet connection for **up to 16 compressors** - without CPM-C Compressor Interface modules; .	Max.Number of compressors: 16 Measuring Data logger Inputs: 98 DI-Digital Inputs: 68 AI-Analog Inputs 4-20 mA: 16 DO-Digital outputs: 68 CI-Calculated Inputs: 64 PI-Power measuring Input: 16

Compressor interface modules for CAL-PM-X:	Description:
CAL-C-ON/OFF 	Compressor Interface Module kit-ON/OFF compressor module has build in energy efficiency and power management with the Power & Energy meter.This cost-effective sensor is simple to deploy and it's standard build in CS system or can be installed on standard DIN rail in the compressor together with 4 x DI and 4 x DO.
CAL-C-VSD 	Compressor Interface Module kit-VSD compressor module has build in energy efficiency and power management with the Power & Energy meter.This cost-effective sensor is simple to deploy and is standard build in CS system or can be installed on standard DIN rail in the compressor together with 4 x DI, 4 x DO and 2x AO:

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Accsessories:	Description:
CAL-SIM	SIM LTE (3G/4G) subsctription per audit device – charged annualy
CAL-OPT	Optics connection kit add-on for one compressors: 1-port EtherCAT multi-mode fibre optic junction, distance max. 2km EtherCAT coupler with ID switch, multimode fibre optic for E-bus terminals connectors, without optic cable
CAL-485	2 port expansion for RS422/RS485 modbus communication (for 2x4 devices)
CAL-C-ETH	Remote module Ethernet – for standard LAN connection with expansion module option or remote connection via LAN.
CAL-AI4	Expansion 4-channel analog input terminal 4-20mA, 12-bit, 4 x 2-wire system
CAL-AI8	Expansion 8-channel analog input terminal 4-20mA, 12-bit, 8 x 1-wire system
CAL-DI8	8-channel digital input terminal 24VDC, filter 3.0ms, 2-wire system
CAL-C-AO4	Expansion 4-channel analog output terminal 4-20mA, 12-bit, 4 x 2-wire system
CAL-C-AO8	Expansion 8-channel analog output terminal, 4-20mA, 12-bit, 8 x 1-wire system.

Master control options for CAL-PM-X:

CAL-EMCS-2	Control system EMCS for 2 compressors Capable of controlling up to 2 compressors Energy control mode – auto sequence selection Multiple pressure profiles Anti-cycling control
CAL-EMCS-4	Control system EMCS for 4 compressors Capable of controlling up to 4 compressors Energy control mode – auto sequence selection Multiple pressure profiles Anti-cycling control
CAL-EMCS-8	Control system EMCS for 8 compressors Capable of controlling up to 8 compressors Energy control mode – auto sequence selection Multiple pressure profiles Anti-cycling control
CAL-EMCS-16	Control system EMCS for 16 compressors Capable of controlling up to 16 compressors Energy control mode – auto sequence selection Multiple pressure profiles Anti-cycling control
CAL-VIS-X	SCADA- local system visualization for compressor station via LAN Ethernet (ON REQUEST)

CFC-x pressure flow system controler (PFSC) with integrated system controller for CAL-PM-X

CFC	Description
CFC-50-KIT	CALMS flow controller disc valve-pipe DN50, Regulation range: 2-40 bar, max 42 bar resolution 0.05 bar, Range 2-25 m^3/min, without on/off bypass valve, CALMS connection
CFC-65-KIT	CALMS flow controller disc valve-pipe DN65, Regulation range: 2-40 bar, max 42 bar resolution 0.05 bar, Range 2-34 m^3/min, without on/off bypass valve, CALMS connection
CFC-80-KIT	CALMS flow controller disc valve-pipe DN80, Regulation range: 2-40 bar, max 42 bar resolution 0.05 bar, Range 5-45 m^3/min, without on/off bypass valve, CALMS connection
CFC-100-KIT	CALMS flow controller disc valve-pipe DN100, Regulation range: 2-40 bar, max 42 bar resolution 0.05 bar, Range 5-89 m^3/min, without on/off bypass valve, CALMS connection
CFC-150-KIT	CALMS flow controller disc valve-pipe DN150, Regulation range: 2-40 bar, max 42 bar resolution 0.05 bar, Range 8-120 m^3/min, without on/off bypass valve, CALMS connection

*Kit includes: special electric disc valve DN50-100 flange type with electric positioner assembly, sensors and junction box to connect to existing CALMS box via EtherCAT. Full close function up to 40bar.

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