SIEMENS

SICAM BC

AI-5306/MMS55

System Element Manual

DC5-030-2.01

Note

Please observe Notes and Warnings for your own safety in the Preface.

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Preface

This document is applicable to the following product(s):

- SICAM BC

Purpose of this manual

This manual describes the functioning of the system element AI-5306/MMS55 (**M**aintenance **M**onitoring **S**witchgear) and essentially contains

- Functional descriptions
- Technical Specifications
- Descriptions of interfaces to the process and other system elements
- Possible configurations

Target Group

The document you are reading right now is addressed to users, who are in charge of the following engineering tasks:

- Conceptual activities, as for example design and configuration
- Creation of the assembly technical documentation using the designated engineering tools
- System parameterization and system diagnostic, using the designated engineering tools
- Technical system maintenance

Placement in the Information Landscape

Document	Item no.
SICAM RTUs Common Functions Peripheral Elements according to IEC 60870-5-101/104	DC0-011-2

Notes on Safety

This manual does not constitute a complete catalog of all safety measures required for operating the equipment (module, device) in question because special operating conditions might require additional measures. However, it does contain notes that must be adhered to for your own personal safety and to avoid damage to property. These notes are highlighted with a warning triangle and different keywords indicating different degrees of danger.

Danger

means that death, serious bodily injury or considerable property damage **will** occur, if the appropriate precautionary measures are not carried out.

Warning

means that death, serious bodily injury or considerable property damage **can** occur, if the appropriate precautionary measures are not carried out.

Caution

means that minor bodily injury or property damage could occur, if the appropriate precautionary measures are not carried out.

Hint

is important information about the product, the handling of the product or the respective part of the documentation, to which special attention is to be given.

Qualified Personnel

Commissioning and operation of the equipment (module, device) described in this manual must be performed by qualified personnel only. As used in the safety notes contained in this manual, qualified personnel are those persons who are authorized to commission, release, ground, and tag devices, systems, and electrical circuits in accordance with safety standards.

Use as Prescribed

The equipment (device, module) must not be used for any other purposes than those described in the Catalog and the Technical Description. If it is used together with third-party devices and components, these must be recommended or approved by Siemens.

Correct and safe operation of the product requires adequate transportation, storage, installation, and mounting as well as appropriate use and maintenance.

During operation of electrical equipment, it is unavoidable that certain parts of this equipment will carry dangerous voltages. Severe injury or damage to property can occur if the appropriate measures are not taken:

- Before making any connections at all, ground the equipment at the PE terminal.
- Hazardous voltages can be present on all switching components connected to the power supply.
- Even after the supply voltage has been disconnected, hazardous voltages can still be present in the equipment (capacitor storage).
- Equipment with current transformer circuits must not be operated while open.
- The limit values indicated in the manual or the operating instructions must not be exceeded; that also applies to testing and commissioning.

Table of Contents

1 Introduction

Content

1.1 Application

The system element AI-5306/MMS55 is a peripheral element with microprocessor support and is used in automation unit SICAM BC. It is deployed for monitoring gas isolated switchgears (GIS) and for acquisition of 16 analog inputs according IEC-60870-5-101/104.

System element type	Peripheral element
consists of	a module AI-5306 with firmware MMS55
can be used in	SICAM BC and SICAM BC/M
Engineering	SICAM TOOLBOX II with OPM II

1.2 Features and Functions

Peripheral element for maintanance and monitoring of selected switchgears

- 16 analog inputs, galvanically insulated from logic (±20 mA)
- Sample rate 1 ms
- Acquisition and processing according to IEC 60870-5-101/104

1.3 Architecture

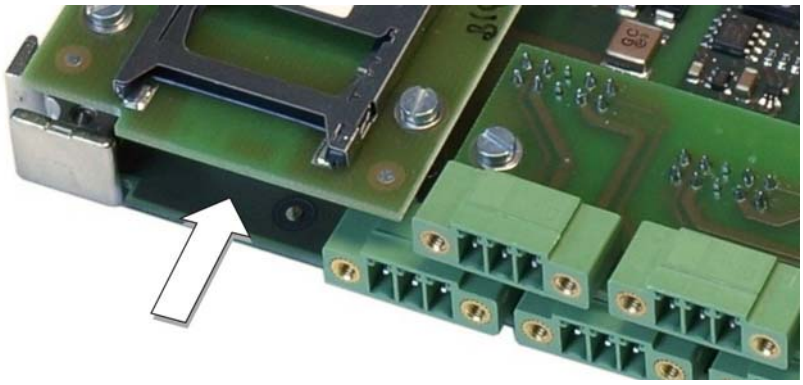
1.3.1 Mechanics

Module in double-euro format for equipping in a 19"-mounting rack.

1.3.2 Ax 1703 Peripheral Bus

The peripheral element is coupled to the basic system element via the Ax 1703 peripheral bus. The address of the peripheral element at the Ax 1703 peripheral bus is already specified during the assembly of the SICAM BC system.

This address can be changed afterwards also by a configuration change with the SICAM SICAM TOOLBOX II. This address is then to be set by means of the PBA switch (⇧) on the peripheral element.



2 Peripheral Element AI-5306/MMS55

Content

2.1 Features and Functions

2.1.1 Acquisition and processing according to IEC 60870-5-101/104

- **Currents**
  - settable acquistion grid n*100 ms [t]
  - measurement range settable with a resloution of [t]
    - 13 bits + sign at ±20 mA
    - shrinking the range results in decreasing resolution
  - revision [t]
  - acquisition
    - noise rejection [t]
    - automatic calibration t
  - smoothing t
  - adaption [t]
    - linear (normalized, technologically scaled or short floating point)
    - suppression of zero range
    - plausibility check
  - change monitoring [t]
  - spontaneous transmission of changes [t]

---

t **Telecontrol**
the function affects process information which is **spontaneously** transmitted

t1 **Telecontrol**
the function delivers (acquisition) **spontaneously** transmitted process information or is controlled by such information (output); partly, periodically transmitted information is also created/required

a **Automation**
the function affects process information which is **periodically** transmitted

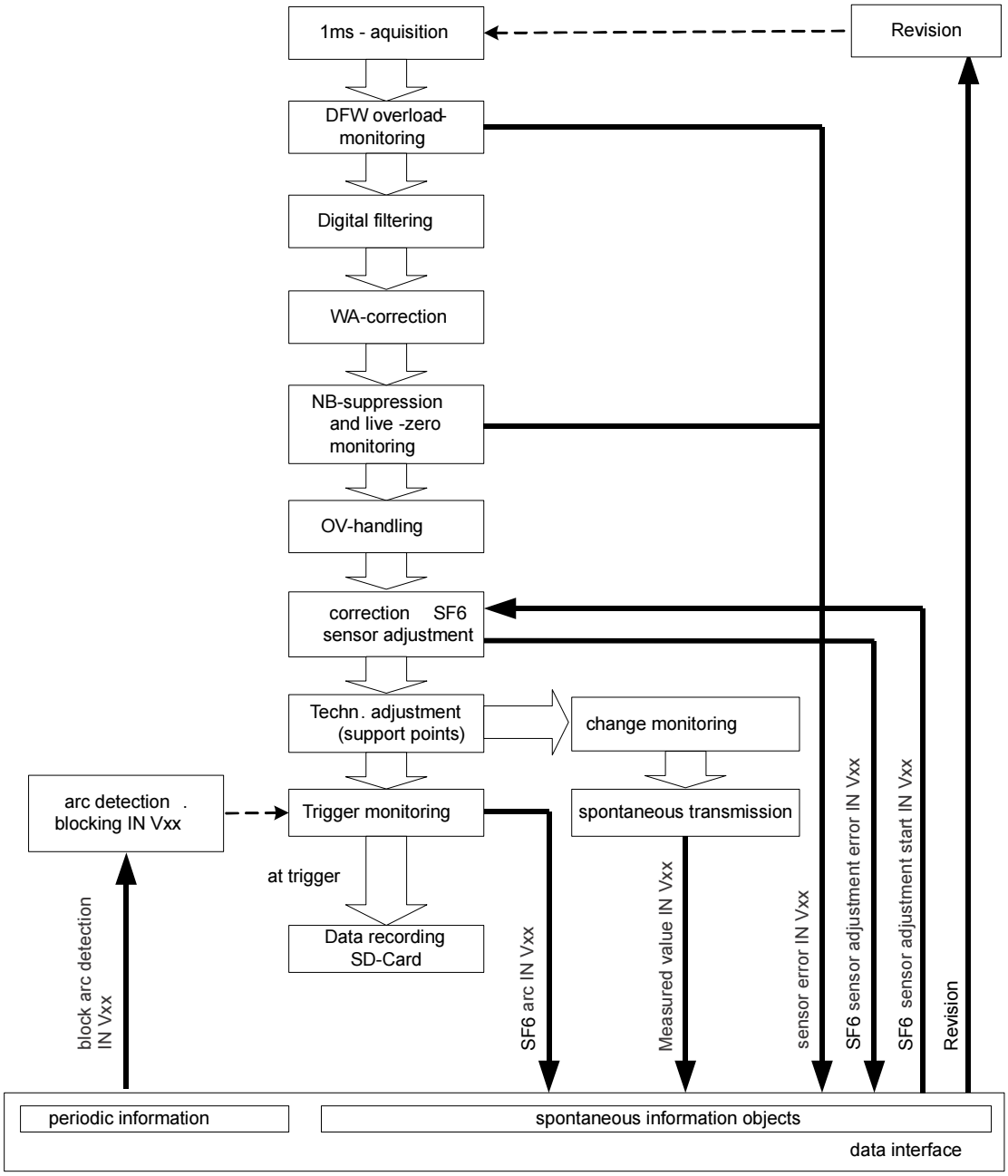
2.1.2 SF6 gas pressure measurement and arc detection

This module is used for recording quick changes in pressure; it has been optimised for SF6 gas-insulated switchgear (GIS) cells. When an arc is generated within an SF6 cell, this can be measured indirectly as a minor short-term pressure increase (typically: 0.01 MPa in 80ms). The analogue module has been designed for quick recording (1 ms).

The functionality of the MMS55 firmware is limited to SF6 gas pressure measurement and arc detection, as well as recording of data on an SD card, as described in the following.

The gas pressure measurement has been implemented for WIKA sensors with non-linear course (see process requirement). Any other functionality required for monitoring switchgear for maintenance purposes is not included in the MMS55 and must be implemented in the form of a function plan integrated in a suitable application.

2.1.2.1 Data flow



2.1.2.2 Digital filtering

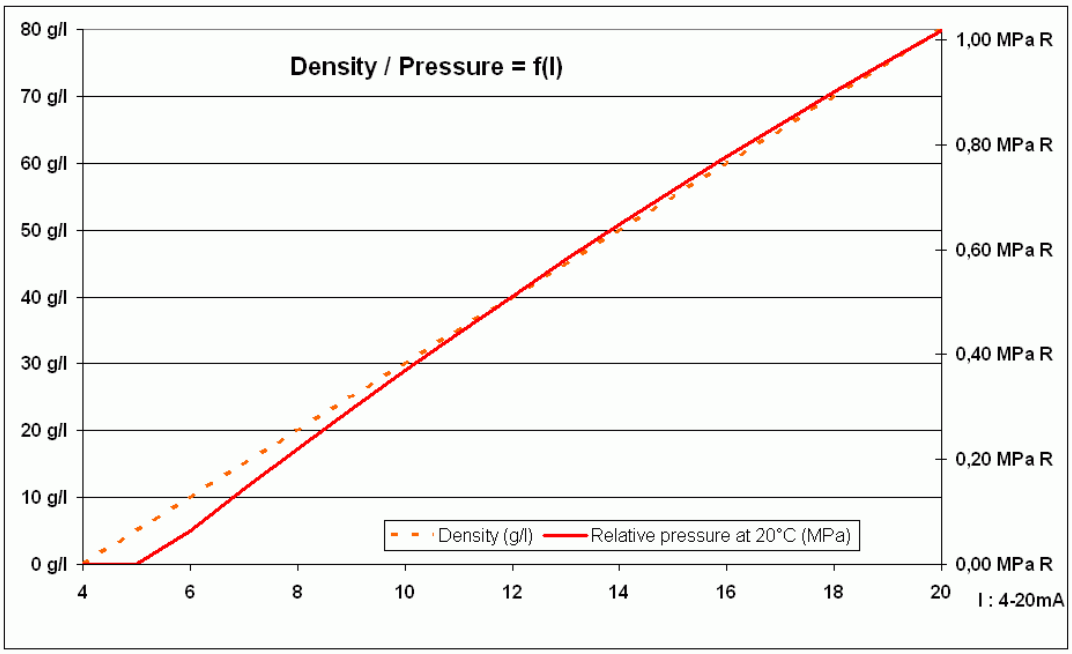
The input signal is digitally filtered as, in the event of an SF6 arc, the wanted signal is superimposed by major interferences that would make arc detection impossible.

Digital filtering delays the input signal by approx. 52.3 ms. This delay is corrected for time stamping (single-point information "SF6 arc", data recorded on SD Card).

2.1.2.3 Technological adjustment (supporting points)

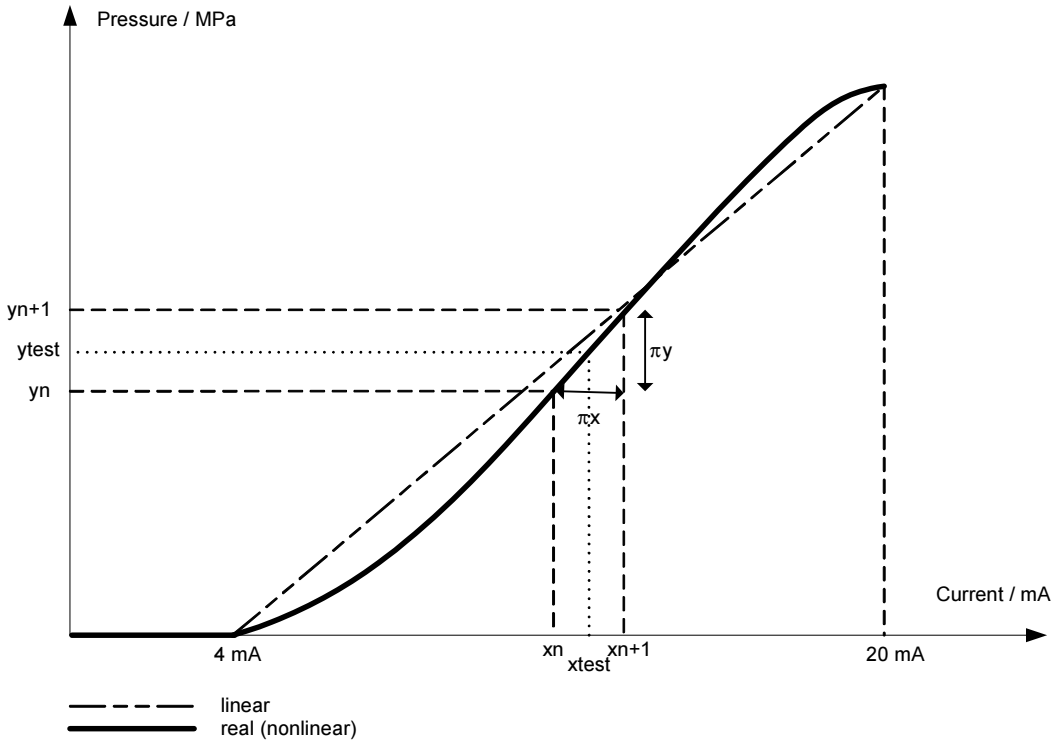
2.1.2.3.1 Process requirements

Recording and processing of measured values has been optimised for the use of temperature-compensated SF6 gas density transmitters (GDT). A 4-20 mA value that is proportional to the gas density (g/l) is delivered. The gas density (g/l) to gas pressure (MPa, referred to 20°C) relationship follows the non-linear curve shown below:



2.1.2.3.2 Non-linear adjustment

An as accurate as possible approximation is required corresponding to the non-linearity of the analogue signal. The approximation is implemented based on a specific number of support points (mA / MPa pair). In between these support points, interpolation is linear (kx+d).



2.1.2.3.3 Support point parameterization

The x-values (mA) of the support points are parameterized using parameters "support point_x0" to "support point_x9", the y-values (MPa) are parameterized using "support point_y0" to "support point_y9".

Parameterization takes place using the data points "Messwert IN Vxx" ("measured value IN Vxx") (category MMS55/AI_MMS_PMS). For more detailed information refer to Section "Parameterization".

xx … input 00 - 15

2.1.2.3.4 Linear adjustment between the support points

An interpolation factor (gradient) is calculated for each support point section as follows:

```
k = dy / dx = (yn+1 – yn) / (xn+1 – xn)
d = yn
```

Interpolation in operation is performed as follows (refer to provided example with xtest, ytest):

1. Determine support point section
xn < xtest < xn+1 => support point section xn – xn+1 / yn – yn+1

2. Determine y-value (MPa) (linear interpolation)
`ytest = [(yn+1 – yn) / (xn+1 – xn)] * (xtest – xn) + yn`

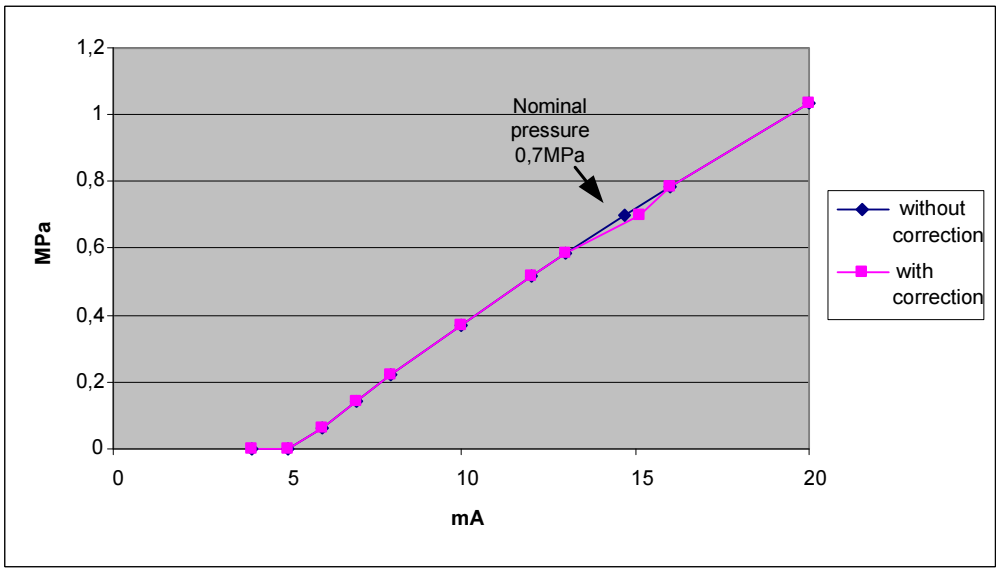
2.1.2.4 SF6 sensor adjustment

2.1.2.4.1 Requirement

Typically, the SF6 gas pressure inside a cell is within a very narrow range around a specific operating point (nominal pressure, e.g. 0.7 MPa). In this range, the required accuracy is very high. Technological adjustment (support points) and scattering of the gas density sensors (+/- tolerance) result in deviations that are to be minimised through adjustment when changing the sensor.

2.1.2.4.2 Principle

The nominal pressure is considered in the technological support point adjustment. The corresponding x-value (mA) at nominal pressure is adjusted.



Curve "without correction":
→ This curve results from the parameterization of the support points (nominal pressure is not considered)

Curve "with correction":
→ The x-value (mA) referring to nominal pressure has already been determined, i.e. SF6 sensor adjustment was performed.

→ The adjustment value (x-value for nominal pressure) and the nominal pressure result in an additional support point that is considered in the technological adjustment.

2.1.2.4.3 Adjustment procedure

- SD card must be inserted !
  The adjustment value is stored on the SD card
- Take measures to ensure that there is a nominal pressure in the cell
- Single-point information "SF6 Sensorabgleich Start IN Vxx" ("SF6 sensor adjustment start IN Vxx") with state ON for the corresponding channel
- Wait for approx. 5 seconds
  → If OK, the diagnostic information "Fehler SF6 Sensorabgleich" ("SF6 sensor adjustment error") and the single-point information "Fehler SF6 Sensorabgleich" ("SF6 sensor adjustment error") are reset.
- Single-point information "SF6 Sensorabgleich Start IN Vxx" ("SF6 sensor adjustment start IN Vxx") with state OFF for the corresponding channel

Possible errors (signalisation via the diagnostic information and the single-point information "Fehler SF6 Sensorabgleich" ("SF6 sensor adjustment error")):

- Adjustment value is outside the plausible range
- SD card not inserted
- SD card defective

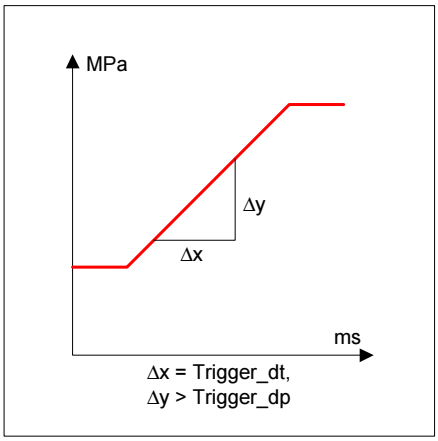
These errors are set only for the duration of the adjustment process, i.e. for as long as the single-point information "SF6 Sensorabgleich Start IN Vxx" ("SF6 sensor adjustment start IN Vxx") with state ON is present.
After that, processing continues with the old adjustment values, if available.

2.1.2.5 SF6 arc detection

2.1.2.5.1 Principle

An SF6 arc inside a gas-insulated cell produces a minor pressure increase for a short period (typically: 0.01 MPa in 80ms).

2.1.2.5.2 Trigger condition



The trigger condition is fulfilled if a specific pressure change (specified by parameter "Trigger_dp") takes place within a specific period (specified by parameter "Trigger_dt").

If the trigger condition is fulfilled, the following actions are performed:

- Single-point information "SF6 Überschlag IN Vxx" ("SF6 arc IN Vxx") is transmitted with state ON
  For more detailed information refer to section "SF6 - alarm"
- The pressure curve upon triggering is recorded on the SD card with previous and subsequent history.
  For more detailed information refer to section "SD card data recording"

Parameterization takes place using the data points "Messwert IN Vxx" ("measured value IN Vxx") (category MMS55/AI_MMS_PMS). For more detailed information refer to Section "Parameterization".

xx … input 00 - 15

2.1.2.5.3 SF6 – Alarm

Detection of an SF6 arc is signalised by the single-point information "SF6 Überschlag" ("SF6 arc") with EM state ON.

The time stamp in the single-point information telegram corresponds to the triggering time (resolution 1 ms). Transmission with state OFF takes place 5 s after transmission of the single-point information with state ON.

The alarm signals (single-point information) are assigned via the data points "SF6 Überschlag IN Vxx" ("SF6 arc IN Vxx") (category MMS55/SW_MMS_DI_EM). For more detailed information refer to Section "Parameterization".

xx … input 00 - 15

2.1.2.5.4 Blocking arc detection

This function is used for facilitating deactivation of trigger monitoring during switching actions (e.g. power switch) to prevent triggering of an alarm and SD card recording. Trigger monitoring can be blocked for selected channels. Sensor monitoring and spontaneous transmission of the pressure measurements are not blocked!

The blocking signals (periodical) are assigned via the data points "Überschlagerk. blockieren IN Vxx" ("Block arc detection IN Vxx") (category MMS55/SW_DO). For more detailed information refer to Section "Parameterization".

xx … input 00 - 15

2.1.2.6 Spontaneous transmission of the pressure measurements

2.1.2.6.1 Measured value disturbed

If no validated value can be transmitted, the last transmitted value is transmitted with set IV bit, i.e. the last valid value is frozen.

In the following cases, the measured value is transmitted as disturbed:

- Factory adjustment error
- Live-zero violation detected
- Overload of the 24 V transmitter supply
- Parameter error in support point adjustment

2.1.2.6.2 Measured value overflow

The limit for overflow results from the support point parameterization. The greatest x-value (mA) of the support point parameterization is used (max. 20 mA). Above this limit, the measured value is restricted and the OV bit is set in the telegram.

2.1.2.6.3 Change monitoring

Change monitoring and spontaneous transmission run at a 100 ms cycle, not synchronised for the recording. The pressure measurements (MPa) are transmitted at least every 5 seconds. The following events trigger immediate transmission:

- Measured value change > 5% from the measuring range end value (MPa) compared to the last transmitted one.
  The measuring range end value is equivalent to the greatest value of the support point parameterization (parameters "support point_y0" to "support point_y9")
- IV, BL status change

2.1.2.7 Parameterization

2.1.2.7.1 Technological adjustment (supporting points)

The parameters are contained in the category MMS55/AI_MMS_PMS (pressure measurement).

Parameter	Meaning	Default
Support point_x0	Support point 0 – value on the x-axis (mA)	0
Support point_y0	Support point 0 – value on the y-axis (MPa)	0
:		
Support point_x9	Support point 9 – value on the x-axis (mA)	0
Support point_y9	Support point 9 – value on the y-axis (MPa)	0

Parameter "support point_xn" = 0

→ The support point is not used for technological adjustment.

→ Curves of at least 2 (linear behaviour) and not more than 10 (non-linear behaviour) support points can be parameterized. If less than the maximum possible 10 support points are used, it is irrelevant which support points are used (parameters "support point_x0" and "support point_y0" do not necessarily have to be used for the first support point).

n … 0 to 9

The following parameterizations are not permissible and will result in a parameter error (warning) in the diagnosis:

- The x-value of the first support point is not 4mA
- The x-values (mA) of the support points have not been parameterized in ascending order
- Less than 2 support points have been parameterized

2.1.2.7.2 Arc detection

Parameter	Meaning	Default
Trigger_dp	Pressure change for trigger monitoring (MPa)	0,01
Trigger_dt	Relevant time for trigger monitoring	80

One of the two parameters = 0
→ Trigger monitoring deactivated
→ Parameter error (warning) in the diagnosis

2.1.2.7.3 SF6 – alarm

The alarm information (single-point information) is assigned via the data points "SF6 Überschlag IN Vxx" ("SF6 arc IN Vxx") (category MMS55/SW_MMS_DI_EM).

xx … input 00 – 15

Parameter	Meaning	Default
CASDU1	Telegram address for spontaneous transmission according to IEC 60870-5-101/104	255
CASDU2		255
IOA1		255
IOA2		255
IOA3		255
TI	TI 30 single-point information	

Single-point information is activated by parameterizing CASDU1 and CASDU2 as not equal to default value 255.

2.1.2.7.4 Blocking SF6 arc detection

The blocking signals (periodic information) are assigned via the data points "Überschlagerk. blockieren IN Vxx" ("Block arc detection IN Vxx") (category MMS55/SW_DO).

xx … input 00 – 15

2.1.2.7.5 Spontaneous transmission of the pressure measurements

Assignment takes place via the data points "IN Vxx" (category MMS55/AI_MMS_PMS).

xx … input 00 – 15

Parameter	Bedeutung	Default
CASDU1	Telegram address for spontaneous transmission according to IEC 60870-5-101/104	255
CASDU2		255
IOA1		255
IOA2		255
IOA3		255
TI	TI 36 measured value, short floating point	

Spontaneous transmission is activated by parameterizing CASDU1 and CASDU2 as not equal to default value 255.

2.1.2.7.6 SF6 nominal pressure

Assignment takes place via the data points "IN Vxx" (category MMS55/AI_MMS_PMS).

xx … input 00 – 15

Parameter	Meaning	Default
SF6_nominal pressure	Nominal pressure in the gas-insulated cell (MPa)	0

It must be possible to represent the nominal pressure in the parameterized support point curve. Otherwise, a parameter error is set and the single-point information "Fehler SF6 Sensorabgleich" ("SF6 sensor adjustment error") with state ON is transmitted.

Default value 0 means that no correction is carried out, i.e. technological adjustment is done exclusively using the parameterized support points.

2.1.2.7.7 Tolerance range for SF6 sensor adjustment

Assignment takes place via the data points "IN Vxx" (category MMS55/AI_MMS_PMS).

xx … input 00 – 15

Parameter	Meaning	Default
SF6_Abgl_tol (SF6_adj_tol)	Max. permissible +/- deviation of the measured pressure value from the parameterized nominal pressure during adjustment (% of the nominal pressure)	0

Default value 0 means that no tolerance monitoring takes place during adjustment !

2.1.2.7.8 Starting SF6 sensor adjustment

Assignment takes place via the data points "SF6 Sensorabgl. Start IN Vxx" ("SF6 sensor adjustment Start IN Vxx") (category MMS55/SW_MMS_DO_EM).

xx … input 00 – 15

Parameter	Meaning	Default
CASDU1	Telegram address for spontaneous transmission according to IEC 60870-5-101/104	255
CASDU2		255
IOA1		255
IOA2		255
IOA3		255
TI	TI 30 single-point information	

Single-point information is activated by parameterizing CASDU1 and CASDU2 as not equal to default value 255.

2.1.2.7.9 SF6 sensor adjustment status

Assignment takes place via the data points "Fehler SF6 Sensorabgl. IN Vxx" ("SF6 sensor adjustment error IN Vxx") (category MMS55/SW_MMS_DI_EM).

xx … input 00 – 15

Parameter	Meaning	Default
CASDU1	Telegram address for spontaneous transmission according to IEC 60870-5-101/104	255
CASDU2		255
IOA1		255
IOA2		255
IOA3		255
TI	TI 30 single-point information	

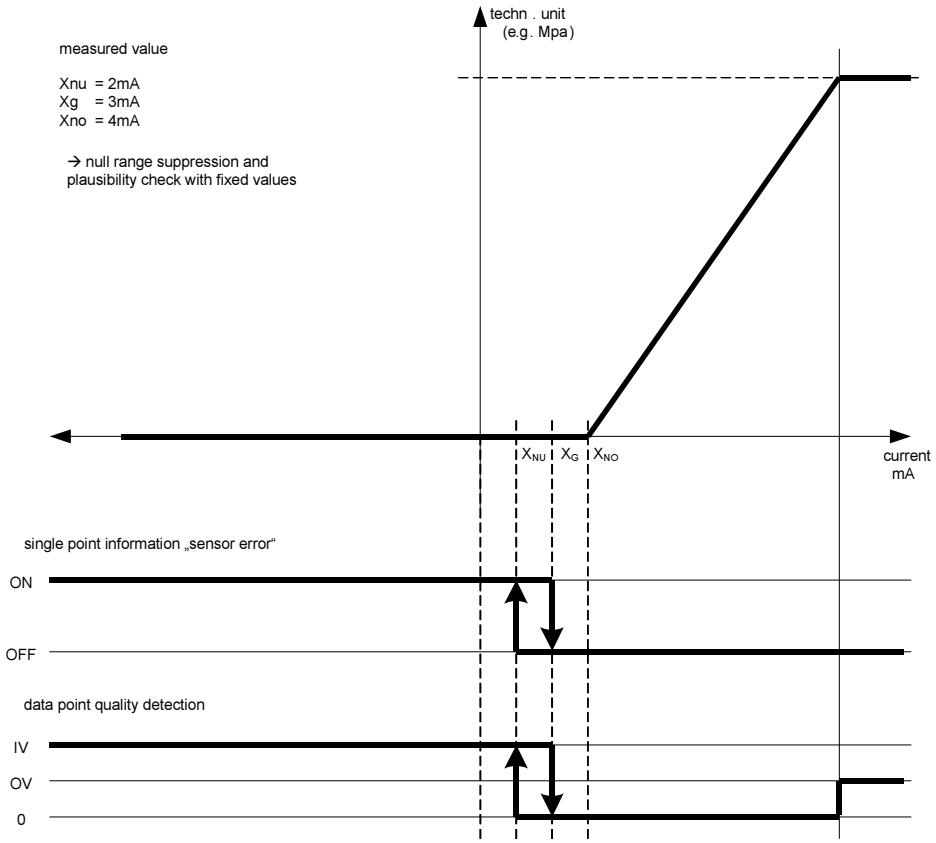
Signalisation is activated by parameterizing CASDU1 and CASDU2 as not equal to default value 255.

2.1.3 Sensor monitoring

The following tests are performed so that errors in the external sensor circuit can be detected:

- Live-zero monitoring
- Monitoring of the 24 V transmitter supply for overload

2.1.3.1 Live-zero monitoring



2.1.3.2 Monitoring of the 24V transmitter supply for overload

Refer to chapter "24V transmitter supply"

2.1.4 Scheduled maintenance

If scheduled maintenance is activated on the module, the current signalisation states and the current measurements are transmitted with status blocked (BL-Bit according to IEC-60870-5-101/104). Recording of measurements is frozen => scheduled maintenance work can be performed.

Scheduled maintenance is transmitted via the single-point information "Revision" ("Scheduled maintenance") with state ON. The data point (single-point information) is assigned in the category MMS55/SW_REV.

2.1.5 SD card data recording

Non-volatile data recording of the recorded trigger events is carried out on an SD card with FAT16 file system. The SD card can be read using a suitable reader and an operating system that supports FAT16 file systems. The recorded trigger events are stored as CSV files (comma separated values) on the SD card.

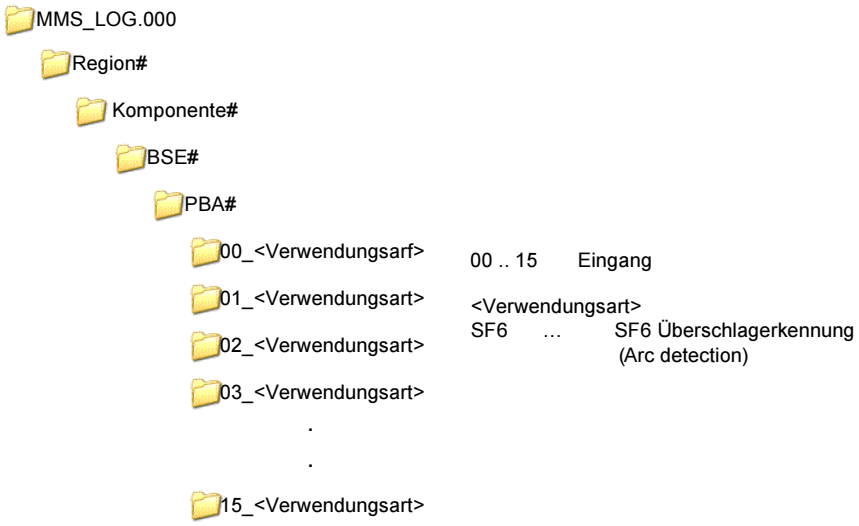
The card can be removed / inserted during operation.

2.1.5.1 Signalising of SD card activity

The error LED flickers during every SD card read or write access. During such time, the SD card may not be removed to prevent data loss or data errors!

2.1.5.2 General directory structure on the SD card

The basic directory structure on the SD card is as follows:



2.1.5.3 SD card identification

The directories "Region#", "Komponente#" ("Component#"), "BSE#" und "PBA#" are used for identification of the SD card. The directories correspond to the technical addressing of the module in the system – module <-> SD card allocation is thus possible and insertion of a "wrong" SD card can be detected.

In order to incorporate system-specific designations in the folder structure, it is possible to use a plain text identifier for the two folders "Region#" and "Komponente#" ("Component#"). The maximum number of characters is 8, no blanks are permitted.

Parameterization takes place using the two general parameters "Reg#_Klartext" und "Komp#_Klartext" in the category MMS55/AI_MMS_PMS.

As can be seen from the diagram in section "General directory structure on the SD card", certain parameterisations in the target system influence the folder structure of the SD card. These are the parameters that are used for comparing the directory structure on the SD card after start-up, inserting of the SD card in operation, or after Load parameters (toolbox). Any inconsistency might be due to one of the following:

- "Incorrect" SD card (SD card of a different module):
  Inconsistency of the technical address in the system → Region#, Komponente#, BSE# or PBA# or respectively parameters "Reg#_Klartext" ("Reg#_plain text") or "Komp#_Klartext" ("Comp#_plain text") changed.
- Parameter change that has an influence on the folder structure of the SD card:
  assignment of the analogue channels changed

  For example: Data point "Messwert IN V07" ("Measured value IN V07") of category "MMS55/AI_MMS_PMS" cancelled, i.e. a directory "07_SF6" exists on the SD card that no longer corresponds to the current parameterization.

Behaviour in the event of inconsistencies – folder MMS_LOG.xxx:

As mentioned above, an inconsistency may have been caused by insertion of a "wrong" SD card or changing of a parameter in the target system that influences the directory structure. In both cases, this has the following identical effect:

A new directory MMS_LOG.xxx is created in that the folder structure is generated in accordance with the parameterization in the target system. In the following, this directory is used as the basis for reading or writing of all files.

xxx …. It is an ascending index starting with "000"
When the SD card is read, this index in the directory name can be used to determine in what directory the latest data can be found.

Generally, the following applies:
If an SD card has been inserted on that several of these directories were saved (MMS_LOG.xxx), the directory with the highest index is always used as the basis for reading or writing the files.

2.1.5.4 Name concept for the CSV files

The CSV files in the individual directories are named "LOG00000.CSV" to "LOG99999.CSV". The 5-digit number in the file name (00000 – 99999) indicates the chronology ("LOG00000.CSV" is the oldest file). The maximum number of CSV files in each directory is 20. If the number of CSV files in the directory has been exceeded, the oldest file is deleted and the new CSV file is saved with ascending index (example: "LOG00020.CSV" instead of "LOG00000.CSV").

Reason:
The oldest trigger event is always saved in the file with the smallest index (chronology based on the index in the file name). Consequently, if the file with the lowest index in the file name is not "LOG00000.CSV", this indicates that one or more CSV files have been overwritten.

2.1.5.5 General structure of a CSV file

CSV (comma separated values) is a simple ASCII file format in that the columns are separated by the semicolon symbol ";" and the rows by CRLF. CSV files can easily be read in diverse tools (e.g. Microsoft Excel) for analysis (e.g. graphical representation of the measurement curve).

The basic directory structure of a CSV file is as follows:

- Header information
- Recorded measurement samples

2.1.5.5.1 Header information

The header information in the CSV file consists of the following entries:

- Path where the CSV is saved
- Time stamp
  The time stamp contains the trigger time with a resolution of 1 ms.
  Format of the time stamp: DD-MM-YYYY hh:mm:ss,xxx

  xxx … ms, 3 digits
- Parameters (depending on the parameterized processing type for the analogue input)
  More detailed information for the individual processing types can be found in the next few chapters.

2.1.5.5.2 Recorded measurement samples

Each CSV file consists of 200 measurement samples. The recording grid depends on the type of use of the input. For more detailed information refer to sections dealing with processing.

The time information for each measurement sample is entered relatively to the trigger time:
Negative time information (ms "-49" to ms "-1") → previous history

ms "0" → trigger time

Positive time information (ms "1" to ms "149") → subsequent history

The technological unit of the measurement sample depends of the type of use of the input. For more detailed information refer to the sections dealing with processing.

2.1.5.6 Removing the SD card in operation

In principle, it is possible to remove the SD card during operation.

Exception:
The SD card may not be removed when the error LED is flickering (SD card read or write access) to prevent data loss or data errors !!

When the SD card has been removed, trigger monitoring continues to be active, however, the recorded trigger events are saved in the RAM only for a short time. A maximum of 10 trigger events can be stored per analogue channel in the RAM. If this number is exceeded, the oldest trigger event is deleted (data loss) and a corresponding diagnostic information is set.

Caution

The trigger events are stored only in the RAM (not permanently) → module failure will result in data loss!

Directly after renewed insertion of the card, the trigger events recorded in the meantime are stored as CSV file on the SD card.

2.1.5.7 Reading the CSV files

A commercially available PC with card reader is required for reading the card. Removal of the recorded CSV files must be carried out using the functions of the PC operating system (e.g. copy/paste in Windows Explorer), automatic data processing or data management via a proprietary tool is not supported.

2.1.5.8 Deleting CSV files

After reading of the CSV files (for data removal refer to previous chapter "Reading the CSV files") it is advised to delete these files from the SD card to make memory space available for further trigger events.

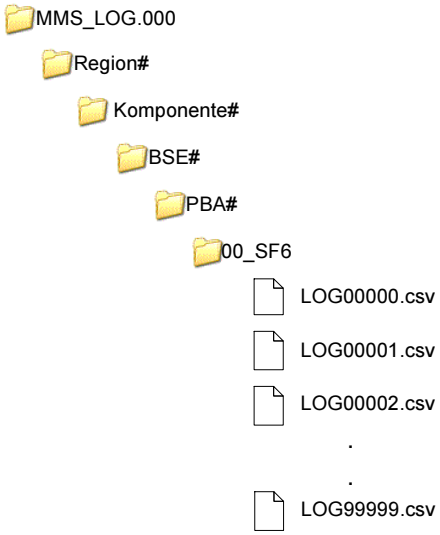
2.1.5.9 Deleting the entire SD card

Instead of deleting individual CSV files (refer to previous chapter) it is also possible to delete the entire SD card contents (all files and directories). When the card is inserted once again after that, the folder structure is re-written on the card in accordance with the target system parameters.

Caution!
If inputs are used for "SF6 arc detection", the files with the adjustment values ("Sensor.adj") are also deleted. These must subsequently be copied manually (no tool support) into the corresponding directories.

2.1.5.10 SF6 gas pressure measurement and arc detection

2.1.5.10.1 Directory structure



In this graph, analogue channel 0 is used for "SF6 arc detection" → directory "00_SF6". In accordance with the number of inputs, up to 16 of these directories can be stored ("00_SF6" to "15_SF6").

2.1.5.10.2 Structure of a CSV file

Example: LOG00000.CSV

```
Path;\MMS_LOG.000\R000\C001\BSE20\PBA05\10_SF6\LOG00000.CSV
Trigger;2001-01-05 16:44:35,665

Trigger condition:
dp;0,0080;MPa
dt;40;ms

Interpolation points:
mA;MPa
4,0;0,000
7,0;0,142
8,0;0,220
10,0;0,369
12,0;0,512
13,0;0,581
14,0;0,648
16,0;0,778
18,0;0,901
20,0;1,018


ms;MPa
-50;0,07815
:
0;0,08641
:
149;0,17925
```

Header

recorded measurement samples

The measurement samples are represented with 5 NK digits.

2.1.6 24 V transmitter supply

Each analogue input provides a 24 V auxiliary voltage for supplying the connected sensor.

The voltage is continuously monitored for overload and, in the event of an error, the following is done:

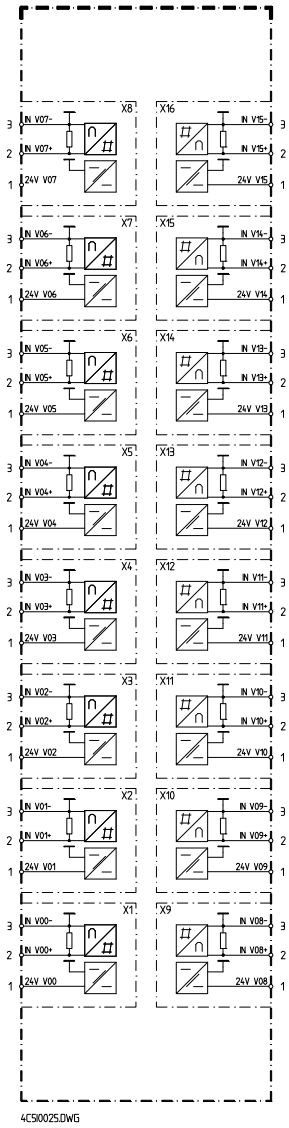
- 24 V voltage for this channel is disconnected
- Diagnostic information "overload of the 24 V transmitter supply"
- Single-point information "Sensorfehler IN Vxx" ("Sensor error IN Vxx") is transmitted with state ON
- SF6 gas pressure measurement (data point cat. AI_MMS_PMS):
  Telegram with disturbed value y0 and set IV bit

If an overload is detected, reconnecting the transmitter supply is tried every 500 ms to ensure immediate readiness for operation once the overload is no longer present.

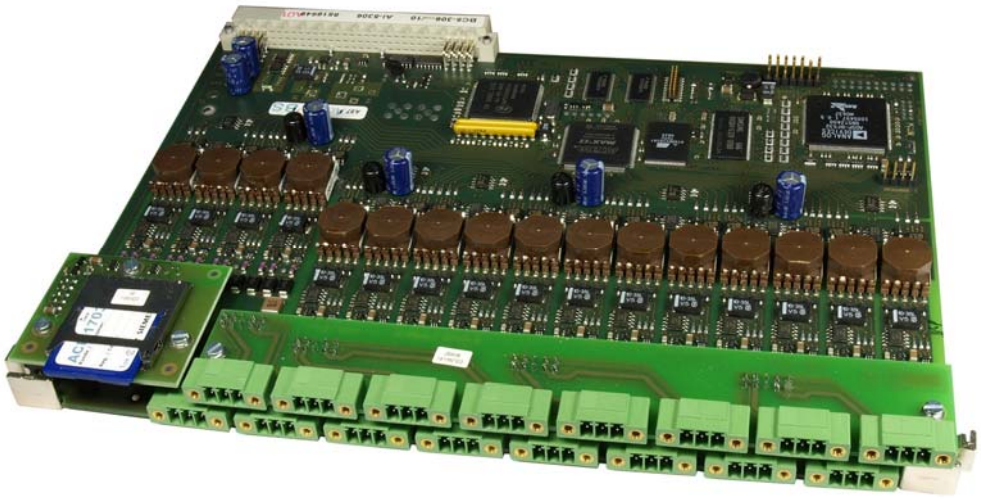
2.2 Engineering

For diagnosis, testing, parameter setting or documentation, the system element is supported by the engineering tools of SICAM TOOLBOX II. OPM II is required.

2.3 Block Diagram



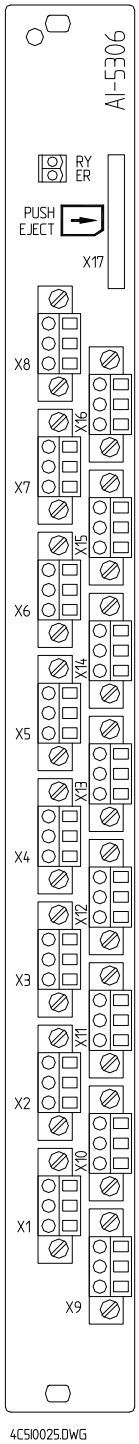
2.4 View



2.5 Technical Specifications

Processor and Memory			
Main Processor	DSP Analog Devices BLACKFIN BF531, 400 MHz		
Program memory	Flash	2 Mbyte	
Main memory	DRAM	8 Mbyte	
Parameter memory	EEPROM	256 Byte	
SD-Card	FLASH CARD	CC6-095 / 6MF12131GA050AA0	
Inputs for Currents			
16 current inputs (X1 – X16)	• Nominal measuring range • Burden • Burden voltage • All inputs are galvanically insulated from logic circuits and ground • Each input is galvanically insulated from each other input	-20 mA…0…+20 mA 121 Ω 2.45 V	
Resolution	13 Bit + sign		
Scan rate	125 µs		
Accuracy	• Start failure • Temperature failure • Long time failure • 50/60 Hz signals • Differential Non Linearity (DNL)	0.25% max 0.5% max 0.3% max 5% max	@ 25°C @ -25 ..+75°C per anno +1 Bit / -2 Bit
Power supply			
Operating voltage	5VDC ± 5% The voltage is picked off at the bus of the mounting rack	15.5 W max 11 W max 7.5 W typ 4 W typ	I_{out} = 8x30 mA I_{out} = 8x20 mA I_{out} = 8x10 mA I_{out} = 8x0 mA
Auxiliary voltage	Each input group has an auxiliary voltage output with: • Voltage • Tolerance • Output current • Overload protection	 24 VDC ±15% 30 mA 35 mA typ	
Mechanics and Connectors			
Dimensions	Double-Euroformat 233.4 x 160 mm, 4WU		
Bus connector (X99, rear side)	VG-connector, 96-pole (DIN 41612), type C (partly equipped)		
Peripheral connectors (X1 – X16, front side)	• FMC 1.5/3-STF-3.5 Phoenix Contact		
Weight	Approx. 260 g (approx. 400 g including front panel and connectors)		

2.6 Front Panel



2.7 Pin Assignment

Removeable screw terminals are used as peripheral connectors. They are assigned according to the following tables. The abbreviations which are used for the signals of the various pins are explained below.

X8:

pin	signal
3	IN V07-
2	IN V07+
1	24V V07

X7:

pin	signal
3	IN V06-
2	IN V06+
1	24V V06

X6:

pin	signal
3	IN V05-
2	IN V05+
1	24V V05

X5:

pin	signal
3	IN V04-
2	IN V04+
1	24V V04

X4:

pin	signal
3	IN V03-
2	IN V03+
1	23V V03

X3:

pin	signal
3	IN V02-
2	IN V02+
1	24V V02

X2:

pin	signal
3	IN V01-
2	IN V01+
1	24V V01

X1:

pin	signal
3	IN V00-
2	IN V00+
1	24V V00

X16:

pin	signal
3	IN V15-
2	IN V15+
1	24V V15

X15:

pin	signal
3	IN V14-
2	IN V14+
1	24V V14

X14:

pin	signal
3	IN V13-
2	IN V13+
1	24V V13

X13:

pin	signal
3	IN V12-
2	IN V12+
1	24V V12

X12:

pin	signal
3	IN V11-
2	IN V11+
1	24V V11

X11:

pin	signal
3	IN V10-
2	IN V10+
1	24V V10

X10:

pin	signal
3	IN V09-
2	IN V09+
1	24V V09

X9:

pin	signal
3	IN V08-
2	IN V08+
1	24V V08

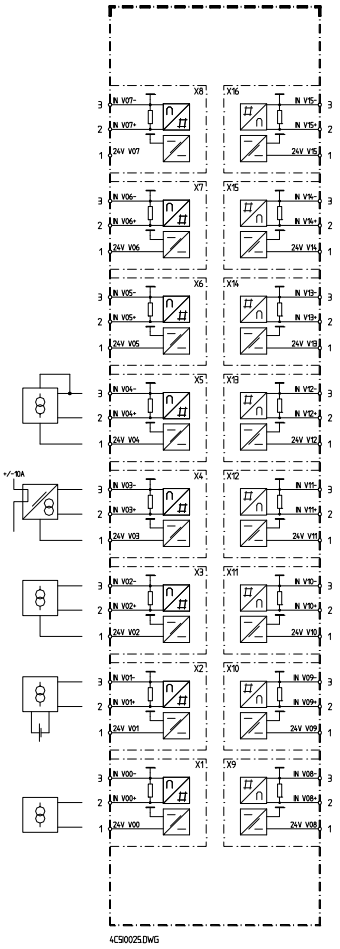
4C510025.DWG

The abbreviations have the following meaning:

24V V00 ... 24V V15 . . . . .auxiliary voltage 24VDC (sensor supply)
IN V00+/- ... IN V15+/- . . .analog current inputs 0 ... 15

4C510025.DWG

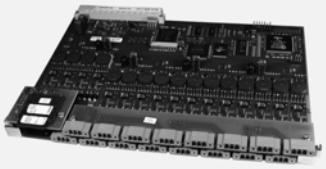
2.8 External Circuit Elements



A Order Information

Content

A.1 System elements

	Designation	Item Number/MLFB
	AI-5306 Analog Inputs 16x +20 mA , 1 ms	BC5-306 6MF10130FD060AA0