

SIEMENS

Add 7 AddFEM (Front End Module)

Manual

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Preface

Product family Add 7

The Add-on products of the Add 7 product family provide a cost-effective solution for the specific high-performance requirements in the field of process control and automation engineering. The design of these products is based on many years of experience in the field of process engineering, and on solid expertise with respect to the current system generation in the Siemens “Totally Integrated Automation” program.

As part of the Add 7 product family, the AddFEM Front End Module satisfies the special requirements of high-speed turbine control systems (different signal types, redundancy, high-speed detection and signal preparation etc.)

Enhancement to module type 6DL3100-8AC compared to 6DL3100-8AA

6DL3100-8AC offers the option of operating the AddFEM in redundant mode (module redundancy), and/or to process signal preparation functions on the AddFEM.

The AddFEM 6DL3100-8AC can be programmed in RUN using DPV1 services.

Further support

If you have any questions about the use of the products described in this manual and do not find the right answers, please contact your Siemens partner at your local Siemens Office or Agencies.

CE Label

Our products are compliant with EC Directive 2004/108/EC “Electromagnetic Compatibility, EC Directive 73/23/EEC “Low-voltage Directive”, and the European Harmonized Standards specified in those directives (EN).



You can view the EC Declaration of Conformity in the appendix. It is available to responsible authorities, according to the EC Directives mentioned earlier, at:

Siemens Aktiengesellschaft
Industry Sector Industry Automation Division
I IA CE SE PRM EN
Siemensallee 84
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1.1 Classification and features

The add-on products of the Add 7 product family provide solutions for specific and high-performance applications in the field of process control and automation engineering.

The Front End Module of the Add 7 product family is tailored to the special requirements of high-speed turbine control systems (different signal types, redundancy, high-speed acquisition and preparation of process data, etc.) AddFEM supports the implementation of loop control systems in the gas-, steam- and water-driven and industrial turbines sector. The AddFEM is also suitable for integrated automation and loop control applications where the emphasis is set on high-speed system reaction times.

The AddFEM offers highly versatile combination options. It supports integration in SIMATIC S7 and SIMATIC PCS 7 systems, and in SPPA-T3000 or SIMADYN D. The AddFEM operates in DP standard slave mode, and is controlled via PROFIBUS DP. The loop control and automation functions are handled as usual by the automation processor.

Signal inputs and outputs

The AddFEM is equipped with analog and digital IOs, including counter inputs for the acquisition of velocity control data.

Due to the optimized composition of signals, and based on an organization by the various signal types, smaller applications can be easily handled by a single AddFEM module. More complex applications, of course, can be handled by integrating several modules.

Each AddFEM provides the following signal inputs and outputs:

- 12 analog inputs, of which six may be operated as current inputs, while the remaining six may be configured in SIMATIC Manager or COM-PROFIBUS for operation as current or voltage inputs
- 8 analog outputs
- 15 digital inputs, of which three are available as counting pulse inputs for the acquisition of velocity control data with and without detection of the rotational direction
- 16 digital outputs, optionally operable as digital inputs

Due to the design of its analog IO measuring ranges, the AddFEM does not require any additional signal transducers when operated in turbine loop control systems. In addition to the usual measuring ranges 0 mA to 20 mA, 4 mA to 20 mA and ± 20 mA, the module provides a ± 30 mA measuring range. An additional ± 50 mA measuring range at the analog outputs supports the control of final control element with higher current consumption, such as fuel control valves, without additional signal amplifier.

All analog and digital outputs are short circuit-proof and monitored, and can be wired in parallel with other outputs. The analog and digital circuits are electrically isolated.

For further technical specifications of the IO, refer to section 4.

Higher availability due to redundancy

Redundancy in this context refers to the integration of a "1 of 2" structure. Availability is enhanced by means of parallel operation of two AddFEM modules. If one AddFEM fails as a result of error, the standby module automatically takes over the functions.

Redundancy of an AddFEM 6DL3100-8AA is controlled by the integrated functions in the automation processor configuration. In contrast, this redundancy control is integrated in the system performance of an AddFEM 6DL3100-8AB/-8AC. The redundancy coupling function on this module is implemented by a fiber optic interface which is used to transfer the status and update data. The extensive, integrated redundancy mechanisms and self-diagnostics functions of AddFEM support automatic error detection and redundant changeover, without any user intervention.

Redundant PROFIBUS DP connection

The AddFEM is equipped with two PROFIBUS DP interfaces (DP A and DP B) which operate in parallel which support the implementation of redundant system structures. All process input data are routed to both PROFIBUS DP interfaces, whereas only the process output data of the currently active DP interface are passed to the output pins. The process output data of the currently passive DP interface are analyzed for the purpose of monitoring. The master standby status of both DP interfaces, i.e. the definition of which DP interface is active or passive with respect to the output data can be set by the automation processor.

Preparation functions

Certain partial automation functions, such as the position control of turbine loop control circuits, can be swapped to the AddFEM as preparation functions. These functions are referred to as front-end function (FEF.)

GSD file

The PROFIBUS DP parameters and properties of the IO (measuring ranges, filtering, for example) of an AddFEM operated on SIMATIC S7 and SIMATIC PCS 7 systems can be set in SIMATIC Manager using HW Config. When operated on a SIMADYN-D system, the corresponding settings are programmed using the COM-PROFIBUS software package.

For information on using the GSD file, refer to the "readme.pdf" on your AddFEM CD.

Module power supply

The AddFEM power supply is designed to operate at a rated voltage of 24 V DC, and at a typical current consumption of 20 W. Voltage dips with a duration of at least 10 ms are buffered. The inrush current is limited to 3 A.

The AddFEM is equipped with an internal 24 V DC power supply for the analog outputs. The 24 V DC load voltage for the digital outputs must be generated by an external power supply which is wired to the X7 connectors.

Design

The AddFEM enclosure is made of stainless steel, and is prepared for screw-mounting or rail mounting.

The signal state of the digital IO is indicated by signal LEDs.

The operating and error states of AddFEM are indicated at 12 separate LEDs. The mode of operation is set by means of a key switch and slider.

The AddFEM front panel features eight 10-pin connectors (total of 80 IO pins) for the connection of process IO signals.

Certifications

In addition to the CE label, the AddFEM is also certified to UL/CSA.

1.1.1 Enhancement of 6DL3100-8AC variant (compared to -8AA/-8AB)

The enhanced DPV1 services of AddFEM are in particular suitable to provide dynamic parameter data (in acyclic mode) to the front-end functions (FEF.) These enhanced functions also support configuration changes in Run (= CiR = Configuration in RUN). CiR lets you reconfigure AddFEM parameters, such as enabling unused channels, or editing the parameters of active channels when using sensors with different technical specifications. The functionality also includes an option of reporting alarms with implicit acknowledgment mechanism for use by the front-end functions.

2.1 AddFEM configuration

The stainless steel enclosure of the AddFEM accommodates the power supply, processors, PROFIBUS DP interfaces, interfaces for process IO signals, redundancy and service interface (fiber optic system), switches and status displays.

All connecting elements are protected with labeled covers.

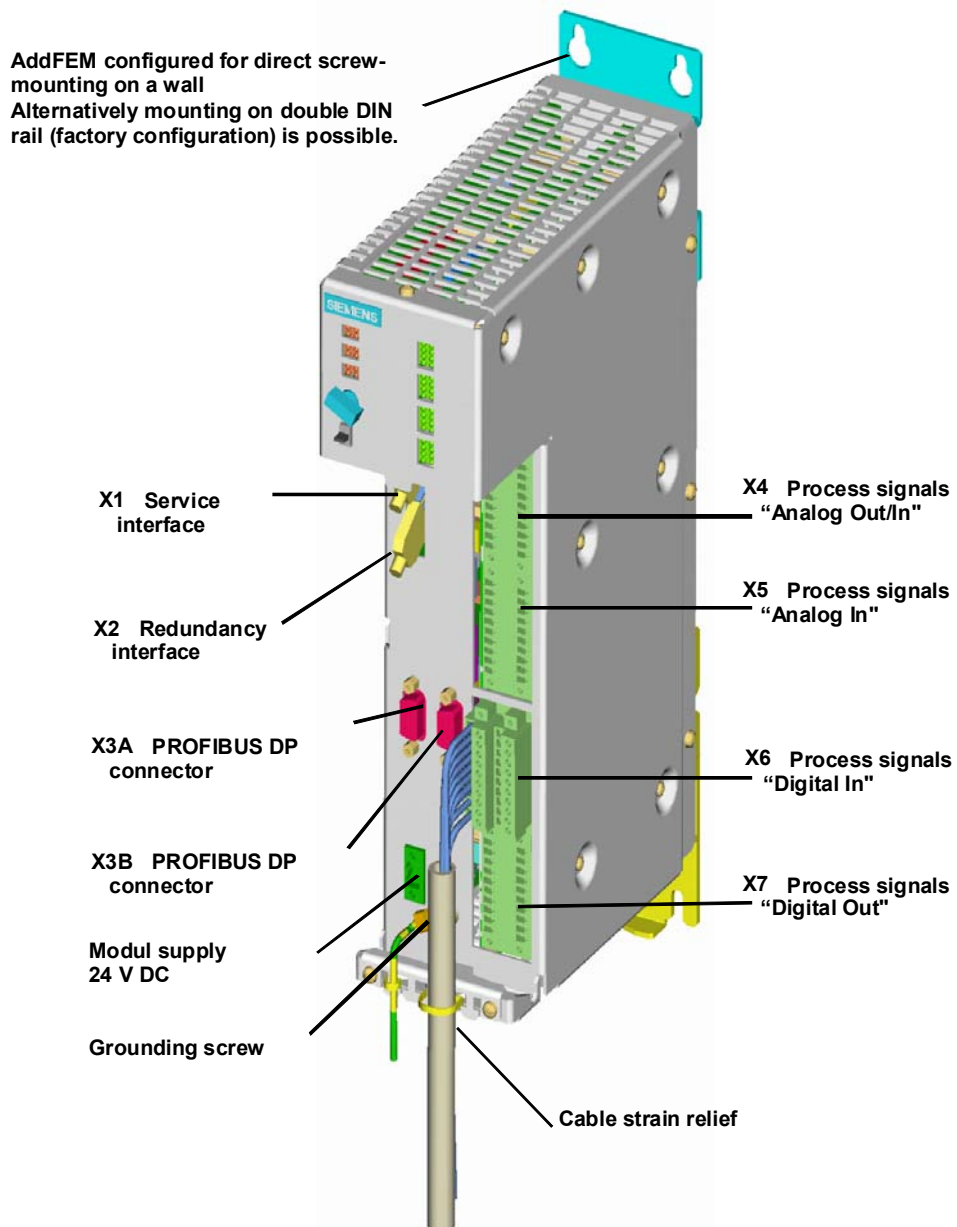


Fig. 2-1 AddFEM, front view

The AddFEM module is suitable for rail mounting, or for wall mounting on steel brackets.

Outer dimensions of the mounting elements: (W x H x D): 75 mm x 290 mm x 190 mm.

2.2 Connecting elements

Module power supply

The AddFEM is wired to the 24 V DC power supply via front connector.

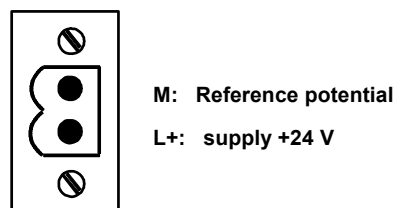


Fig. 2-2 24 V DC module supply

The module current input is limited by an electronic circuit. It is also protected by an F 2.5 A fuse (internal fuse element for the protection against damage; not replaceable.)

The AddFEM can be operated on 19.2 V DC to 30 V DC.

The 19.2 V low limit is monitored.

Load power supply

The AddFEM is equipped with an internal 24 V DC load power supply for the analog outputs. The 24 V DC load voltage for the digital outputs must be generated by an external power supply which is wired to the X7 connectors.

Grounding and electrical isolation

The front panel of the module features a grounding screw below the power supply connector. Module enclosures installed on a non-conductive or ungrounded surface must be bonded to ground using this screw (EMC shielding measure.)

Isolated function areas:

- Microcontroller area, including the analog I/Os
- 24 V DC module power supply
- Digital I/Os

The 12 digital inputs are organized in groups of four, each with a common reference potential. This also applies to the three counting pulse inputs. The 16 digital outputs are distributed to two reference potentials.

Interfaces X1 and X2

- Redundancy interface X2
For redundant operation of two AddFEM modules.
- Service interface X1
For commissioning and maintenance.
Only with 6DL3100-8AC05 (AddFEM PoCo Plus), this interface is used as an additional redundancy interface for channel-selective redundancy switching of analog inputs for position feedback messages.

PROFIBUS DP connectors X3A und X3B

The AddFEM is equipped with two PROFIBUS connections for communication with the automation processor.

Process connections X4 to X7

The process IO signals are wired to sockets X4 to X7. The corresponding mating connectors are equipped with screw terminals for conductor cross-sections from 0.14 mm² to 1.5 mm² (AWG 28-16.)

3.1 General functions

Introduction

Disruptions or errors should be detected, localized and reported within the shortest possible time. The AddFEM performs a full self-test after POWER ON (Run Up Self Test), and periodically in normal cyclic operation (Cycle Self Test.) (see "Technical specifications", section 4.2)

Self-tests/inherent monitoring function:

Components and functions included in the test:

- RAM test
- RAM checksum test (calibration data, program code)
- FEPRM checksum test (calibration data, program code)

Self-tests in cyclic mode

Certain self-test operations must be synchronized with the I/O cycle, and are thus part of this cycle.

Self-tests within the IO cycle:

- RAM test
- PROFIBUS functionality
- Data transfer host <-> AddFEM
- Data transfer <-> redundant AddFEMs
- Cycle times
- Power supply
- Channel errors of process IO
- Coprocessor monitoring by master processor

Delayed shutoff

After a brief host failure or loss of PROFIBUS DP communications, the process outputs will be shut down if a programmable tolerance time is exceeded.

This tolerance time can be set within a range from 10 ms to 3 s.

The default is 0.5 s.

(see section 5.6.1 "Adjustable parameters")

3.3 Operating modes

System configurations

The AddFEM can be configured for operation in stand-alone or redundant mode on one or two PROFIBUS DP channels. There are four available system configurations. The configuration must be programmed. See also 5.6.1 "Adjustable parameters".

The AddFEM module does not automatically detect and adapt a configuration. The mode of operation is set up on the AddFEM using a PROFIBUS DP parameter frame, and is determined by the required system configuration.

Note:

The basic setting selected for the AddFEM redundancy mode supports the replacement of a 6DL3100-8AA module with a 6DL3100-8AB/-8AC module without conversion of the configuration.

Setting the mode of operation

When using SIMATIC S7, you can configure the PROFIBUS DP parameters in HW-Config of SIMATIC Manager. Use the COM-PROFIBUS software package to make the corresponding settings for other systems.

Mode	Host	AddFEM	PROFIBUS
0	single-channel	single-channel	1 PROFIBUS DP segment
1	redundant	single-channel	2 PROFIBUS DP segments
2	single-channel	Redundant	1 PROFIBUS DP segment
3	redundant	Redundant	2 PROFIBUS DP segment

Note

After POWER ON, the AddFEM holds the STARTUP (LED RUN flashes) state until its operating mode parameters are set (see section 5.6.1).

4.1 Technical specifications

General data	
Dimensions (H x W x D)	295 mm x 75 mm x 209 mm
Weight	2.8 kg
Input voltage, rated value permissible range	24 V DC static: 19.2 V DC to 30 V DC dynamic: 18.5 V to 30.2 V
Rated input current Module supply Load supply	0.8 A 8 A
Inrush current Peak Half intensity width	3 A, limited 100 ms
Buffering of power failure	at least 10 ms, at input voltage 19.2 V DC to 30 V DC
Cumulative power loss of AddFEM - Module supply - Supply at digital inputs - Supply at analog inputs - Switching and feed forward losses at digital outputs on load power supply	max. 33 W (cumulative) max. 20 W max. 4 W max. 1 W max. 8 W
Module power supply fusing	2.5 A, fast-blow (internal protection, not replaceable)
Load power supply fusing	2 x 7 A, fast-blow (internal protection, not replaceable)
<u>Electrical isolation</u> The module consists of several electrically isolated function groups. The potential difference between these function groups may not exceed 50 V when the system is in operation. Assignment of signals and connections to the various function groups: a) Analog IO (connectors X4/1 to X4/20, and X5/1 to X5/20), including the internal microcontroller area b) Count pulse inputs (connectors X6/1 to X6/4) c) Digital inputs 5 to 8 (connectors X6/6 to X6/10) d) Digital inputs 9 to 12 (connectors X6/11 to X6/15) e) Digital inputs 13 to 16 (connectors X6/16 to X6/20) f) Digital outputs 1 to 8 (connectors X7/1 to X7/10) g) Digital outputs 9 to 16 (connectors X7/11 to X7/20) h) PROFIBUS DP connector X3A i) PROFIBUS DP connector X3B j) Module power supply 24 V DC k) Enclosure	

PROFIBUS DP interfaces	
Number of interfaces	2
Transmission rate	9.6 kbps to 12 Mbps
Max. cable length of a bus segment terminated at both ends	100 m
Permitted load on the 5-V power supply of the bus for the connection of further nodes without internal power supply	max. 80 mA per interface
For detailed information on PROFIBUS, refer to SIMATIC NET, PROFIBUS Networks manual, order no. 6GK1970-5CA20-0AA0!	

IO cycle times (PROFIBUS and connectors X4 to X7)	
Analog signal acquisition	666.667 µs
Analog signal output	666.667 µs
Digital signal acquisition ¹⁾	666.667 µs
Digital signal output	666.667 µs
Count pulse input	2 ms

¹⁾ Refresh signal at intervals of 666.667 µs. Signal filtering incurs an additional dead time of 666.667 µs between acquisition and output.

Digital inputs (channels 5 to 16)	
Number of inputs	12
Type of input to IEC 61131-2	Type 1
Voltage range	- 30 V DC to + 30 V DC
0 signal level	- 30 V DC to + 5 V
1 signal level	+ 11 V to + 30 V
48 V contact voltage	no
Connection of BEROs supported	yes
Min. current at input voltage	5 mA at 11 V (see Fig. 4-1)
Delay time (TID)	50 μ s at 0 > 1 signal transition 50 μ s at 1 > 0 signal transition
Displays	Front panel LEDs; indicate the converted values read by the internal microcontroller unit.
Terminal assignments	See appendix A, connector X6, page A-2

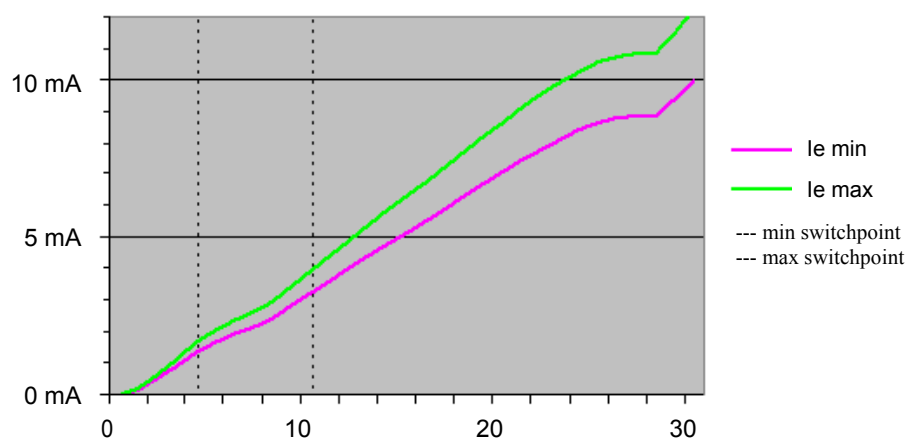


Fig. 4-1 Trend of digital inputs with tolerances of input current I_e

Digital inputs (channels 17 to 32)	
Depending on the configuration, the pins of connector X7 can be operated as digital output or as digital inputs (channels 17 to 32). Below are the technical specifications of these pins when used as digital inputs.	
Number of inputs	16
Type of input to IEC 61131-2	Type 1
Voltage range	- 30 V to + 30 V DC
0 signal level	- 30 V to + 5 V
1 signal level	+ 11 V to + 30 V
48 V contact voltage	no
Connection of BEROs supported	no
Input current	~0.34 mA at 11 V / ~0.84 mA at 24 V
Delay time (TID)	50 μ s at 0 to 1 signal transition 50 μ s at 1 to 0 signal transition
Displays	Front panel LEDs indicate the converted values read by the internal microcontroller unit.
Terminal assignments	See appendix A.1, connector X7, page A-2

Count pulse inputs ¹⁾ (channels 1 to 3)	
Number of inputs	3
Type of input to IEC 61131-2	Type 1 / 2
Voltage range	- 28 V DC to + 28 V DC
0 signal level	- 28 V to + 3 V
1 signal level	+ 8 V to + 28 V
Demand factor when operated at a voltage > 26 V	The count pulse inputs are also specifically designed to handle low input voltages (high signal detection => 8 V.) To limit power losses, either the input voltage must be limited to 26 V, or a 60% pulse/pause ratio with a maximum pulse width of 1 minute must be maintained, or only two of the three inputs may be set high at any given time.
Load	1 k Ω to 3 k Ω
Current/ voltage profile across the working range	See Fig. 4-1!
Dealy time (TID)	50 μ s at 0 > 1 signal transition 50 μ s at 1 > 0 signal transition
Cyclic evaluation of all signals	2 ms Noise pulses < 10.667 μ s are suppressed by filtering. Additional hardware evaluation by counters.
Input frequency (f_m)	0 kHz to 20 kHz
Counter resolution	32 bit
Measuring accuracy	better than 10^{-4} of measrued value
Refresh interval	2 ms
Measuring time at frequencies < 800 Hz	20 ms
Filter	At each refresh scan cycle point, the system recalculates the frequency based on a mean value derived from the count pulses logged within the last 20 ms.
Detection of the rotational direction	The rotational direction can be determined by coupling channels 1 and 2. See section 3.2 (supported as of version 8 of 6DL3100-8AA, version 7 of 6DL3100-8AB, and by all versions of 6DL3100-8AC)
Displays	Front panel LEDs; indicate the converted values read by the internal microcontroller unit.
Terminal assignments	See appendix A, connector X6, page A-2

¹⁾ Count pulse inputs may also be used as digital inputs!

Digital outputs ¹⁾	
Number of outputs	16 digital semiconductor outputs
Rated output voltage	DC 24 V
Output voltage at 0 signal	< 1 V
Output voltage at 1 signal	supply voltage – 2 V
Max. output current	500 mA Parallel wiring of outputs for higher currents is supported.
Output current at 100% demand factor	500 mA
Cumulative output current	8 A
Effect of repeated overload on multi-circuit modules	none
Monitoring of short-circuit to M	yes
Short circuit-proof	yes
Max. lamp load per output	5 W
Inductive loads	Connection of inductive loads is supported. Compared to standard suppression diodes, the suppression voltage of integrated suppression diodes is increased by 39 V, and accelerate the shutoff of the current and, thus, of the final control element. However, the maximum suppression power (1 W) may not be exceeded.
Typical values:	
Max. inductivity at $I \leq 500$ mA and $f \leq 1$ Hz	8 H (without external suppression diode)
Max. inductivity at $I < 250$ mA and any f	unlimited
Max. inductivity with external suppression diode	unlimited
Output delay (TQD, Totzeit) between command output and response of the output (start of current rise)	20 μ s at 0 > 1 signal transitions 20 μ s at 1 to 0 signal transitions
Output response time (TQT) between command output and transient state of the output current at 500 mA	50 μ s at 0 > 1 signal transitions 50 μ s at 1 > 0 signal transitions
Reaction to the interruption of runtime controlled by the master processing unit	Shutoff of the outputs
Reaction to dips and interruption of the power supplies L1+ or L2+ at X7/1 or X7/11	The output voltage follows the supply voltage.
Displays	The voltage level of the digital outputs is logged by the internal digital inputs of the module, and is then converted and read by the internal microcontroller unit. The microcontroller unit outputs the read states to the front panel LEDs.
Terminal assignments	See appendix A.1, connector X7, page A-2

¹⁾ Digital outputs may also be used as digital inputs!

Analog inputs	
Input impedance across the signal range for current measurement for voltage measurement	41.8 Ω 100 k Ω
Measuring error Max. error at 25 °C Temperature coefficient	$\pm 0.12 \%$, at 0 V CMV ± 25 ppm/K
Max. error across the temperature range	$\pm 0.2 \%$ relative to measuring range limit at a CMV of max. 2 V
Digital resolution of the D/A converter	13 bit + sign
Value of the least significant bit (LSB) bei Strommessung bei Spannungsmessung	4 μ A 2 mV
Highest permissible continuous overload (no damage)	60 V
Output of the digitized analog value under load	118 %
Input type	Differential
CMV range	± 6 V
CMV suppression DC 50 Hz 60 Hz	- 0.05 % / V 55 dB 55 dB
Total system input transfer time (TAID + TAIT)	52 μ s
Scan time including settling time	20 μ s
Scan cycle interval time	104.167 μ s
Input filter of the first order Transition frequency	880 Hz
Mean value formation across four measurements Transitional frequency including input filter	700 Hz
Max. short-term offset during any defined electrical error test	See EMC data (section 4.2)
Conversion method	successive approximation / parallel conversion of 4 channels
Mode of operation	autoscan
Calibration	not required
Terminal assignments	See appendix A.1, connector X5, page A-1!

Analog outputs	
Number of analog outputs	8
Max. error at 25°C	± 0.15 %
Temperature coefficient	± 100 ppm / K
Max. error across the temperature range	± 0.4 %
Value of the least significant bit (LSB)	13 bit + sign
Value of the least significant bit (LSB)	8 µA
Total system transfer time (TAQD + TAQT)	1 ms
Transient time across the full range	0.6 ms
Overshoot	0.2 %
Max. short-term offset during any defined electrical error test	See EMC data (section 4.2)
Terminal assignments	See appendix A.1, connector X4, page A-1
Max. permitted inductive load	1 H
Power Off operations	Buffer time up to 10 ms. With prolonged failure, power on is determined by software functions
Conversion method	parallel conversion of all 8 output channels
Current output range unipolar / overflow range / load	0 ... 20 mA / ± 23.5 mA / 480 Ω 4 ... 20 mA / – 4,96 bis + 22,96 mA / 480 Ω
Current output range bipolar / overflow range / load	± 20 mA / ± 23.5 mA / 480 Ω ± 30 mA / ± 35.55 mA / 300 Ω
Current output bipolar (only channels 1 to 4) ¹⁾	± 50 mA / ± 59.26 mA / 150 Ω
Output current monitoring tolerance	4 %
Cross-talk between channels at:	
DC	≤ 60 dB
50 Hz	≤ 60 dB
60 Hz	≤ 60 dB
Non-linearity	± 0.1 %
Output ripple	± 0.1 %

¹⁾ In order to protect the module, the analog outputs 1 to 4 are limited to an average load of 40 mA. The extension of the current range of those outputs to 50 mA / 59.26 mA is only intended for the control of final control elements with integral action. A max. current of 59,26 mA is provided to this purpose for a limited time.

The current is monitored by the software and limited as follows.

Mean value limiting: At a current output programmed for operation at ±50 mA, the mean value of the output current is calculated based on a delay element of the first order which has a time constant of 10 s. If the current exceed a mean value of 40 mA, both the output current and its mean value will be limited to ±40 mA.

4.2 Safety, environmental conditions and EMC

Certifications:

6DL3100-8AA/-8AB/-8AC is certified to:

- UL-Recognition-Mark: Underwriters Laboratories (UL) to Standard UL 508
- CSA-Certification-Mark: Canadian Standard Association (CSA) to Standard C 22.2 No. 142

CE label

6DL3 100-8AA/-8AB/-8AC meets requirements of EC Directive 2004/108/EC "Electromagnetic Compatibility"

Safety	
Device standard	EN 61131-2, IEC 61131-2, parts 11 to 14
Inherent heating	The enclosure made of steel sheet is subject to an excess temperature of approx. 20 K under full load. The temperature limit of 70 °C is thus exceeded at an ambient temperature of 60 °C, which still allows unprotected contact without any risk of injury (to DIN EN 61131-2.).
Power supply	The 24 V DC power supply must be a safety extra-low voltage which is safely isolated from mains. This isolation may be implemented in accordance with VDE 0100 Part 410 , HD 384.4.41 , IEC 60364-4-41 (as functional extra-low voltage with safe isolation PELV) or to EN 60950-1, IEC 60950-1 (as safety extra-low voltage SELV).
Installation safety requirements	6DL3100-8AA/-8AB/-8AC is an "open equipment" to DIN EN 61131-2 standard, and according to UL/CSA certification an "open type." In order to satisfy operational safety requirements with respect to mechanical strength, non-inflammability, stability and touch protection, the following installation methods are mandatory:: Installation in a suitable cabinet Installation in a suitable enclosure Certified only to DIN EN 61131-2: Installation in a closed switch room with appropriate equipment
Electrical isolation	Isolation of the areas specified in section 4.1 is designed for normal operation at a rated voltage of 50 V. The routine insulation test is carried out to UL 508 (test voltage/duration 707 V DC / 1 min, or optional at 849 V DC / 1 s when the test object is switched off.
Foreign matter and water-proofing	Degree of protection IP20 to IEC 529, i.e. protected against contact with standard test fingers. Not water-proof.
Sound emission	None

Climatic conditions	
Temperature (ambient temperature) Operation	Tested to DIN EN 60068-2-1, DIN EN 60068-2-2, 0 °C to + 50 °C at rated load (see chapter 4.1) 0 °C to + 55 °C at rated load; digital outputs 5, 6, 7, 8, 13, 14, 15 and 16 but with max. 200 mA load 0 °C to + 60 °C at rated load; digital outputs 3 to 8 and 11 to 16, but with max. 120 mA load; Input voltage at the binary inouts max. ± 28 V; normal operation on PROFIBUS, without load on the additional PROFIBUS supply for 80 mA (i.e. no nodes without internal supply, for example, fiber optic converters, connectable) maximum temperature gradient 10 °C / hour
Storage / packaged ready for shipping	Tested to DIN EN 60068-2-1 and DIN EN 60068-2-2: - 40 °C to + 70 °C maximum temperature gradient 5 °C / hour (Risk of dewing at higher temperature gradients. Dewing is not permitted.) With longer shelf times it is advisable to put the modules into operation for approx. one hour at regular intervals, in order to prime the electrolytic capacitors: At shelf temperatures up to 40 °C: after 5 years within the first 10 years, then at intervals of 3 years; At shelf temperatures above 40 °C: at intervals of 2 years;
Relative humidity Operation	max. 95 % at + 25 °C, dewing is not premitted, corresponds with relative humidity (RH) stress group 2 to IEC 61131-2. Tested to IEC 60068-2-78: 95 % at 30 °C
Storage / packaged ready for shipping	Max. 95 % at + 25 °C, dewing not permitted; Tested to IEC 60068-2-30: 95 % at 25 °C to 55 °C
Barometric pressure	Storage: 1080...660 hPa (-1000 to + 3500 m) Operation: 1080...900 hPa (-1000 to + 1000 m) The cooling effect is reduced at higher elevations, i.e. the high temperature limit may be reduced (guide value: 10 K/1000 m, starting at 1000 m above sea level)
Pollutant concentration	SO ₂ < 0.5 ppm, rel. humidity < 60 %, no condensation H ₂ S < 0.1 ppm, rel. humidity < 60 %, no condensation

Mechanical ambient conditions	
Vibration operational, with screw mounting or rail mounting (see section 5.1)	Tested to DIN EN 60068-2-6: 10 Hz to 58 Hz: amplitude 0.075 mm 58 Hz to 500 Hz: acceleration 1 g (10 m/s ²) Excitation signal: floating sine wave Frequency transient: 1 octave/min, 10 cycles per axis
Packaged ready for shipping	Tested to DIN EN 60068-2-6: 5 Hz to 8.5 Hz: amplitude 3.5 mm 8.5 Hz to 500 Hz: acceleration 1 g (10 m/s ²) Excitation signal: floating sine wave Frequency transients: 1 octave/min, 10 cycles per axis

5.1 Installing the AddFEM

The brackets of the AddFEM are adaptable and are thus suitable for mounting the AddFEM module on DIN rail, or for wall-mounting.

Always secure the 24 V DC power supply and process cables on the strain relief.

Installation to DIN EN 61131-2

6DL3100-8AA/-8AB/-8AC is an “open equipment” according to DIN EN 61131–2 standard, and an “open type” according to UL/CSA certification.

In order to satisfy safety requirements with respect to mechanical strength, non-flammability, stability and touch protection, the following installation options are mandatory:

- Installation in a suitable cabinet
- Installation in a suitable enclosure
- Certified only to DIN EN 61131-2:
Installation in a closed switch room with appropriate equipment.

CAUTION

Danger of burns to hands from hot surface

Hot surface can cause burns

The temperature rise of the metal enclosure at full load is approximately 20 K. At an ambient temperature of 60 °C, the temperature limit of 70 °C is exceeded. This limit represents the maximum temperature up to which unprotected contact without risk of injury (according to DIN EN 61131-2) is possible.

Do not touch the enclosure without appropriate protective measures when the ambient temperature is > 50 °C.

Mounting options

Module mounting options:

- Mounting on double DIN rail (factory configuration)
- Direct screw-mounting on a wall

DIN rail mounting

The minimum clearance (measured center <-> center) between the top and bottom DIN rail is 165.1 mm (see the dimensional drawing for DIN rail mounting.) The minimum stiffness of the DIN rail structure must be sufficient to ensure safe fixation of the module. We therefore recommend the installation of rails to DIN EN 60715 (minimum material thickness: 2.2 mm), with a fastening pitch of less than 25 cm. DIN rails with a length of 19 inches should be bolted at the sides and in the middle.

Grounding the module enclosure

The module enclosure must be grounded to ensure EMC compatibility. It suffices to mount the module onto grounded DIN rails (DIN rail mounting) or a grounded mounting panel (screw mounting).

If suitable mounting elements are not available, the enclosure must be connected to ground separately at the grounding screw on the front panel below the module's power socket. This screw can be connected to a grounded cable.

Additional information on system installation with respect to lightning protection, grounding etc., refer to the SIMATIC PCS 7 documentation on the Internet e.g. "Automation System S7-400 Hardware and Installation"

Connecting the module power supply

The 24 V DC power supply is connected to the AddFEM using the dual-pole connector of the AddFEM connector set, order no. 6DL9900-8AA. At an ambient temperature of 60 °C, the terminal temperature may reach 70 °C (The cable insulation should thus be certified for a temperature 75 °C.)

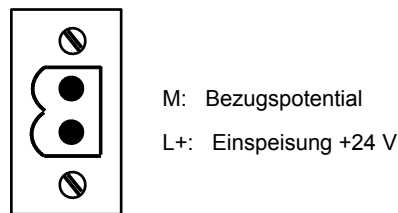


Fig. 5-3 24 V DC module power supply

Always use solid wire or stranded wire with wire end ferrules to connect the module to the 24 V DC power supply (stripping length: 7 mm).

Tightening torque of the screw terminals of the connector:
0.5 N/m to 0.6 N/m

⚠ WARNING Danger, high voltage May cause death or serious injury The 24 V DC module power supply must be a safety extra low voltage (SELV) which is safely isolated to mains. Safe electrical isolation may be implemented to VDE 0100 part 410, corresponding to HD 384.4.41 and IEC 60364-4-41 (as functional extra-low voltage with safe isolation PELV) or EN 60950-1, IEC 60950-1 (as safety extra low voltage SELV)

Connecting the load voltage supply for digital outputs

AddFEM supplies the 24 V DC load voltage to the analog outputs. The 24 V DC load voltage for the digital outputs must be generated externally, and is wired to the X7 connectors.

Connecting the process cables

Cable type: Cables carrying analog signals must be shielded in order to achieve maximum protection against interference (see "Supplementary data on safety, environmental conditions and EMC "). You may use unshielded cables for the transfer of digital signals.

In accordance with the UL / CSA certification of the matching front connectors for sockets X4 to X7 (connectors with 10 screw terminals, AddFEM connector set, order no. 6DL9900–8AA), process signals may only be connected using solid copper wire or stranded wire with wire end ferrules (stripped length: 9 mm). At an ambient temperature of 60 °C, the temperature in the area of the terminals may reach 70 °C. The cable insulation should therefore be certified to withstand a temperature of 75 °C.

Tightening torque of the screws when connecting wires: 0.22 N/m to 0.25 N/m.

WARNING

Danger, high voltage

Dangerous contact voltages caused by transients or incorrect connections may occur in the process and be transferred to the module by way of the connectors.

These voltages may lead to death or serious injury in the event of contact.

Contact by the user with these voltages is possible at the following locations:

- *Locking screws of process connectors:*
Contact with the locking screws used to secure the cable cores to the process connectors is possible when attaching the cables or handling the connection plugs.
- *Pins on the module front connector:*
If the process connectors are only partially inserted onto the module front connectors, dangerous contact voltages may be transferred from the fully inserted pins to the still exposed pins via the module.

Keep the protective cover of the AddFEM closed during normal operation.

If you open the protective cover, first disconnect the connection to the process or take suitable precautions to prevent contact with the open pins or locking screws.

Cable strain relief

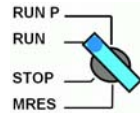
The AddFEM front panel is equipped with a strain relief rack made of metal which is used to secure the cables and wires using cable ties. You can remove this rack, including the cables and wires mounted to this rack, by loosening the two screws, and then mount it onto the replacement module.

5.3 Operator control and display elements

Operator controls

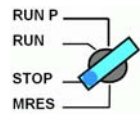
All control and display elements of the AddFEM are located on the front panel above the protective cover.

The AddFEM can be operated by means of a key switch and slide switch on the front panel. The various switch positions are described below.



Normal operation – analog outputs enabled.

In this position you can remove the key in order to prevent any unauthorized change of the operating mode.

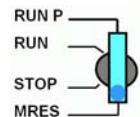


Outputs are disabled.

In redundant mode of the AddFEM, this forces a master / reserve changeover, i.e. the AddFEM is now the “reserve” module.

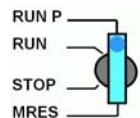
You can set the PROFIBUS DP addresses and reset the AddFEM.

In this position you can remove the key in this position in order to prevent any unauthorized change of the operating mode.



Key switch position, with momentary action function.

Required for setting up the PROFIBUS DP addresses.



Reserved for function expansions.

You cannot remove the key when it is in this position.



Position 0 – Spring-loaded momentary action:

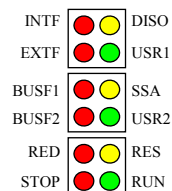
The PROFIBUS DP addresses are indicated on the signal LEDs in binary code.

The display is activated for the duration of approx. three seconds.

Position 1 – latching position: home position

Position 2 – latching position: no function

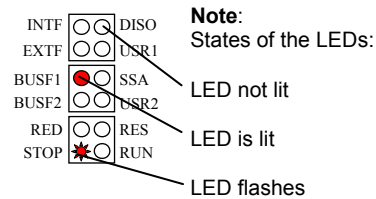
LED



Three LED arrays above the key switch. Each with 4 LEDs for alarm (left) and status signals (right).

Operating states

D The "POWER ON" to "RUN ACTIVE" operating states described below are indicated by the status and error LEDs. The states are listed in the order of the module startup sequence.



Operating states:

POWER ON	INTF DISO EXTF USR1 BUSF1 SSA BUSF2 USR2 RED RES STOP RUN	LED test After power on or reset, all error and status LEDs are switched on for the duration of approx. two seconds.
INIT	INTF DISO EXTF USR1 BUSF1 SSA BUSF2 USR2 RED RES STOP RUN	Initialization phase Functions executed by the AddFEM in this phase: • Setup of hardware functions • Self-test • Wait state, approx. 4 seconds until PROFIBUS DP frames are received • Indication of the address currently set at PROFIBUS DP A (socket X3A) in binary format on the 16 signal LEDs for the digital inputs. If any fatal errors occur, the AddFEM is reset to and set to "RESET" state
STARTUP	INTF DISO EXTF USR1 BUSF1 SSA BUSF2 USR2 ED RES STOP RUN	Startup phase The AddFEM locks in the startup phase if it does not receive any PROFIBUS DP frames., the reasons being: • The PROFIBUS DP master is not ready yet • The PROFIBUS DP connector is missing or defective, or not terminated yet.
LOAD PARAMETER	INTF DISO EXTF USR1 BUSF1 SSA BUSF2 USR2 RED RES STOP RUN	Configuration If the parameters required for the operation of the respective AddFEM variant are not transferred by HOST (PROFIBUS DP master), the AddFEM will remain in this phase. Possible reason: • Incorrect or missing driver block (T3000 HW proxy or PCS 7 driver) • With PoCo Plus as of FEF revision 03, the module remains in this state if parameter values are outside the permissible range (TN, SETO_TIME1 or YPI_TIME2 > 262 seconds)
CONNECT PASSIVE	INTF DISO EXTF USR1 BUSF1 SSA BUSF2 USR2 RED RES STOP RUN	Connecting to the redundancy partner - reserve The system synchronizes data with the redundant partner (i.e. between the redundant AddFEM and this module) via the redundant fiber optic cable connection. The module then goes into RUN PASSIVE state.
CONNECT ACTIVE	INTF DISO EXTF USR1 BUSF1 SSA BUSF2 USR2 RED RES STOP RUN	Connecting to the redundancy partner – master The system synchronizes data with the redundant partner (i.e. data of the redundant AddFEM and this module) via the redundant fiber optic cable connection. The module then goes into RUN ACTIVE state.

Display functions of the error and status LEDs

LED	Error class/ status	Display	Cause
INTF	Internal error	INTF  DISO EXTf  USR1 BUSF1  SSA BUSF2  USR2 RED  RES STOP  RUN	The automatic monitoring function has detected an internal error. The INTF LED is lit in case of - Memory error - Corrupted analog signal calibration data in memory.
EXTf	External error	INTF  DISO EXTf  USR1 BUSF1  SSA BUSF2  USR2 RED  RES STOP  RUN	External errors The EXTf LED is lit in case of LED lights for: - Faulty process signal "Analog Out" - Faulty process signal "Analog In" - Faulty process signal "Digital Out" 24 V DC load voltage missing at digital outputs
BUSF1	Bus error 1	INTF  DISO EXTf  USR1 BUSF1  SSA BUSF2  USR2 RED  RES STOP  RUN	PROFIBUS DP interface A (X3A). The LED is statically set when the master monitoring function has responded
		INTF  DISO EXTf  USR1 BUSF1  SSA BUSF2  USR2 RED  RES STOP  RUN	The LED flashes if configuration errors are detected, i.e. the parameter assignment frame contains illegal parameter values. .. the parameter values received do not match the configuration of the redundancy partner
BUSF2	Bus error 2	INTF  DISO EXTf  USR1 BUSF1  SSA BUSF2  USR2 RED  RES STOP  RUN	PROFIBUS DP interface B (X3B). The LED is statically set when the master monitoring function has responded
		INTF  DISO EXTf  USR1 BUSF1  SSA BUSF2  USR2 RED  RES STOP  RUN	The LED flashes when configuration errors are found, i.e. the parameter assignment frame received contains illegal parameter values. ..the parameter values received do not match the configuration of the redundancy partner
RED	Redun- dancy error	INTF  DISO EXTf  USR1 BUSF1  SSA BUSF2  USR2 RED  RES STOP  RUN	Relevant only with redundant configuration of the AddFEM. The LED is lit... ...if the fiber optic cable connection between the two redundant AddFEM modules has failed.
		INTF  DISO EXTf  USR1 BUSF1  SSA BUSF2  USR2 RED  RES STOP  RUN	The LED flashes... if the configuration of the redundant AddFEMs is not consistent.

STOP	Offline (Stop)	INTF  DISO EXTf  USR1  SSA  USR2 RED  RES STOP  RUN	The AddFEM is in STOP. The outputs are disabled. A master / reserve changeover of the redundant module is forced, i.e. the module is set to "forced reserve." In this state, you can also set the PROFIBUS DP addresses and reset the AddFEM.
DISO	Output disabled	INTF  DISO EXTf  USR1 BUSF1  SSA BUSF2  USR2 RED  RES STOP  RUN	All outputs are disabled for the duration of commissioning or maintenance work. The AddFEM is in STOP, or in (passive) reserve state in redundant mode.
USR1	User status 1	INTF  DISO EXTf  USR1  SSA BUSF2  USR2 RED  RES STOP  RUN	USER LED 1 Can be used in the signal preparation function (FEF) for specific applications. For more, refer to information in the operating instructions of the respective AddFEM FEF variant. e.g. AddFEM PoCo Plus
SSA	Set Slave Address	INTF  DISO EXTf  USR1 BUSF1  SSA BUSF2  USR2 RED  RES STOP  RUN	The LED is lit when you set the PROFIBUS DP addresses
USR2	Users status 2	INTF  DISO EXTf  USR1 BUSF1  SSA BUSF2  USR2 RED  RES STOP  RUN	USER2 LED: Can be used in the signal preparation function (FEF) for specific applications. For more, refer to information in the operating instructions of the respective AddFEM FEF variant. e.g. AddFEM PoCo Plus
RES	AddFEM is standby	INTF  DISO EXTf  USR1 BUSF1  SSA BUSF2  USR2 RED  RES STOP  RUN	AddFEM in standby
RUN	"Online" status	INTF  DISO EXTf  USR1 BUSF1  SSA BUSF2  USR2 RED  RES STOP  RUN	All functions can be executed

Table 5-2 Description of the error / status LEDs

Legend: ● LED is lit ✱ LED is flashing

Note: If you do not find the displayed error state in Table 5-2, check Table 5-1 to find displays for the operating states in order to determine if the AddFEM has remained in the module startup phase due to another error.

Note

For EXTf error displays for redundant AddFEM. The **EXTf** LED indicates errors in the process output signals (analog outputs, digital outputs). The reserve module assumes the master function if a signal error is detected on the master module. The **EXTf** error display, (e.g. after a wire break at the analog output remains stored on the reserve module, however, and cannot be reset because reserve module no longer outputs signals and therefore cannot check the line status.

Refer to section 5.5 "Resetting errors with module redundancy" for the procedure for **EXTf**, if the display has been caused by an "Analog out" process signal error (e.g. wire break at an analog output) or "Digital out" process signal error (e.g. short circuit to ground).

5.4 Setting the PROFIBUS DP address

Each PROFIBUS DP node must be assigned a unique address which can be set in the number range "1" to "125." You can set the PROFIBUS DP address of your AddFEM using the key switch and slide switch, or in SIMATIC Manager. Both options are described below. For redundant PROFIBUS DP connections, it may be useful to assign the same address to both PROFIBUS DP of an AddFEM module. You may also set different addresses. Any address you assign will be written to the non-volatile memory area of AddFEM and is thus retained after power failure. When operating three to four AddFEMs on each PROFIBUS DP segment (typical configuration in turbine control systems), you should preferably assign addresses in the lower range, for example, "2", "3", "4" or "5", in order to simplify setup procedures.

5.4.1 Setting the address of PROFIBUS DP A using the key switch and slide switch

The next section describes how to set the addresses of PROFIBUS DP A and B. This setting is made with the help of the key switch and slide switch. The status LED returns the setup status. The signal LEDs temporarily indicates the set PROFIBUS DP addresses in binary format. The display is coded according to the tables below.

5.6 Configuring the AddFEM

The AddFEM is configured via PROFIBUS DP according to procedures defined in the PROFIBUS standard.

The CD supplied with your AddFEM contains a GSD file you can edit using the usual PROFIBUS configuration tools, such as HW-Config or COM-PROFIBUS. Based on this file, the configuration tool generates a master parameter data set. This set will be saved to memory in the automation processor (AP), and downloaded to the AddFEM within the initialization phase.

For further information, refer to the description of the configuration tool used.

For further information on using the GSD files, refer to "readme.pdf" on the AddFEM CD.

5.6.1 Adjustable parameters

Parameter	Range/Value	Remarks
Operating mode AddFEM	"Standard not redundant " "AS red., AddFEM not red. " "AS not red., AddFEM red. " "AS red., AddFEM red."	Mode 0 Mode 1 Mode 2 Mode 3 (see also section 3.3 "Operating modes")
Redundant AddFEM	"No redundant partner" "PROFIBS-Address: 1"	This parameter is available only with "SIMATIC PCS7" configuration. Default setting is "No redundant partner"
Input type/range AI 1 Input type/range AI 6	"Current 4...20 mA" "Current 0...20 mA" "Current +/-20 mA" "Current +/-30 mA" "Voltage +/-10 V" "Voltage 0...10 V"	The analog inputs 1 to 12 support channelselective adjustments. The analog inputs 1 to 6 can be programmed for operation as voltage or current input mode.
Input type/range AI 1 Input type/range AI 6	"Current 4...20 mA" "Current 0...20 mA" "Current +/-20 mA" "Current +/-30 mA"	Analog inputs 7 to 12 can only be use in current input mode.
Output type/range AO 1 Output type/range AO 8	"Current 4...20 mA" "Current 0...20 mA" "Current +/-20 mA" "Current +/-30 mA" "Current +/-50 mA"	The analog outputs 1 to 8 support channel selective adjustments. They are implemented for operation in current output mode Note: If the current range is set to +/- 50 mA, the analog outputs are limited to a mean load of 40 mA to protect the module. Please see technical specification: Analog outputs
Counter 1	"Ident. of rot. direction off" "Ident. of rot. direction on"	Counter 1 can be programmed for operation with or without detection of the rotational direction. If detection of the rotational direction is enabled, channel 1 returns the leading and channel 2 the lagging signal.
Filter AI 1 Filter AI 12	"No filter" "Filter 50 Hz" "Filter 60 Hz" "Filter 16 2/3 Hz" "Filter 500 Hz"	A filter function can be programmed for each analog input to suppress the relevant mains frequency. Sth system provides filters for 50 Hz, 60 Hz, 16 2/3 Hz and 500 Hz ¹⁾ . The filtering can be set individually for each analog input (channel-selective). Default setting is "No filter" i.e. disabled! ¹⁾ As of version 14 of 6DL3100-8AC
Delayed shutoff (if the host CPU becomes unavailable briefly. For details please see 0 "Delayed shutoff ")	"0 ms" "10 ms" "20 ms" "50 ms" "100 ms" "200 ms" "500 ms" (default) "1 s" "2 s" "3 s"	The AddFEM is capable of compensating short-term gaps in the execution cycle of the host CPU, for example, when the system updates redundant APs. A "hard" shutoff of the outputs is not carried out unless the set tolerance time has expired

Table 5-8 Adjustable parameters

5.6.2 Integration in automation systems

Siemens provides drivers and / or configurations for the integration of AddFEM in various host systems. Those drivers support the easy integration of AddFEM in different system environments. A description of this integration and of its configuration is available in the manuals and documentation of the relevant systems.

5.6.2.1 Overview of automation systems

System	CPU/PROFIBUS interface	AddFEM type	GSD	Comment
SPPA-T3000	S7 400 with internal on-board PROFIBUS interface or with CP443-5 EXT expansion module	6DL3100-8AC 6DL3100-8AC02 6DL3100-8AC03 6DL3100-8AC05	SiT680A3.GS? (Standard for SPPA-T3000)	GSD model name: AddFEM/SPPA-T3000 - Suitable for hardware proxies on the SPPA-T3000 system - Configuration of AddFEM in HW Config as "redundant standard slave" (automatic integration in redundant bus systems) is supported - Diagnostics interrupts are supported - No editable parameters – parameters are always assigned in acyclic DP-V1 jobs - Front-End-Function: configurable PoCo, PoCo Plus and SoE
S7-400/FM458 TXP AS 620T	S7 400/FM458-1_DP with internal on-board PROFIBUS interface, with external EXM448 expansion module	6DL3100-8AC	SiF080A3.GS? (Standard for FM458)	GSD model name: AddFEM/FM458 - Suitable for integration in the DP interface of FM458 - Diagnostics interrupts are not supported - Basic functionality (IO) + redundancy changeover of AddFEM with fiber optic connection - Front-End-Function: not configurable
SIMATIC PCS7	S7 400 with internal on-board PROFIBUS interface or with CP443-5 EXT expansion module	6DL3100-8AC 6DL3100-8AC02 6DL3100-8AC03	Si0580A3.GS? (Standard for SIMATIC PCS 7)	GSD model name: AddFEM/PCS7/PARAM - Suitable for PCS7 channel drivers - Configuration of AddFEM in HW Config as "redundant standard slave" (automatic integration in redundant bus systems) is supported - Diagnostics interrupts are supported - Front-End-Function: configurable PoCo and SoE
TXP AS 620 B	SIMATIC S5 155H/ AS 620 B with PROFIBUS communications module	6DL3100-8AC	SiT080A3.GS? (Standard for TXP AS 620 B)	GSD model name: AddFEM/TXP S5 - Suitable for integration in TXP S5 with IM308-C - Diagnostics interrupts are not supported - Front-End-Function: not configurable
SIMADYN D TXP AS 620 T	PM6 (PM5) with CS7 communications module, and SS52 communications module for the PROFIBUS DP interface	6DL3100-8AA	Si0180A3.GS?	GSD model name: Add FEM, Type -8AA Basic functionality (only IO)
		6DL3100-8AB	Si0280A3.GS?	GSD model name: Add FEM, Type -8AB Not for new projects!
S7-400/FM458 TXP AS 620T	S7 400/FM458 EXM448 expansion module for the PROFIBUS DP - interface	6DL3100-8AA	Si0180A3.GS?	GSD model name: Add FEM, Type -8AA Basic functionality (IO) + redundancy changeover of AddFEM with fiber optic connection
		6DL3100-8AB	Si0280A3.GS?	GSD model name: Add FEM, Type -8AB Not for new projects!

Appendix

A.1 Front connector pin assignment

Connector X4

Pin no.	Name	Function	Pin no.	Name	Function
1	NC	n.c.	11	NC	n.c.
2	S1+	Analog output channel 1	12	M1+	Analog input channel 1+
3	S2+	Analog output channel 2	13	M1-	Analog input channel 1-
4	S3+	Analog output channel 3	14	M2+	Analog input channel 2+
5	S4+	Analog output channel 4	15	M2-	Analog input channel 2-
6	S5+	Analog output channel 5	16	M3+	Analog input channel 3+
7	S6+	Analog output channel 6	17	M3-	Analog input channel 3-
8	S7+	Analog output channel 7	18	M4+	Analog input channel 4+
9	S8+	Analog output channel 8	19	M4-	Analog input channel 4-
10	M	Reference potential AO / AI	20	M	Reference potential AI

Connector X5

Pin no.	Name	Function	Pin no.	Name	Function
1	NC	n.c.	11	NC	n.c.
2	M5+	Analog input channel 5+	12	M9+	Analog input channel 9+
3	M5-	Analog input channel 5-	13	M9-	Analog input channel 9-
4	M6+	Analog input channel 6+	14	M10+	Analog input channel 10+
5	M6-	Analog input channel 6-	15	M10-	Analog input channel 10-
6	M7+	Analog input channel 7+	16	M11+	Analog input channel 11+
7	M7-	Analog input channel 7-	17	M11-	Analog input channel 11-
8	M8+	Analog input channel 8+	18	M12+	Analog input channel 12+
9	M8-	Analog input channel 8-	19	M12-	Analog input channel 12-
10	M	Reference potential AI	20	M	Reference potential AI

Connector X6

Pin no.	Name	Function	Pin no.	Name	Function
1	1N	Reference potential channels 1, 2, 3	11	3N	Reference potential channels 9,10,11,12
2	1	Counter/digital input channel 1	12	9	Digital input channel 9
3	2	Counter/digital input channel 2	13	10	Digital input channel 10
4	3	Counter/digital input channel 3	14	11	Digital input channel 11
5	NC	n.c.	15	12	Digital input channel 12
6	5	Digital input channel 5	16	13	Digital input channel 13
7	6	Digital input channel 6	17	14	Digital input channel 14
8	7	Digital input channel 7	18	15	Digital input channel 15
9	8	Digital input channel 8	19	16	Digital input channel 16
10	2N	Reference potential channels 5, 6, 7, 8	20	4N	Reference potential channels 13, 14, 15, 16

Connector X7

Pin no.	Name	Function	Pin no.	Name	Function
1	1L+	Power supply L+ channels 1 ... 8	11	2L+	Power supply L+ channels 9 ... 16
2	1	Digital output channel 1 or Digital input channel 17	12	9	Digital output channel 9 or Digital input channel 25
3	2	Digital output channel 2 or Digital input channel 18	13	10	Digital output channel 10 or Digital input channel 26
4	3	Digital output channel 3 or Digital input channel 19	14	11	Digital output channel 11 or Digital input channel 27
5	4	Digital output channel 4 or Digital input channel 20	15	12	Digital output channel 12 or Digital input channel 28
6	5	Digital output channel 5 or Digital input channel 21	16	13	Digital output channel 13 or Digital input channel 29
7	6	Digital output channel 6 or Digital input channel 22	17	14	Digital output channel 14 or Digital input channel 30
8	7	Digital output channel 7 or Digital input channel 23	18	15	Digital output channel 15 or Digital input channel 31
9	8	Digital output channel 8 or Digital input channel 24	19	16	Digital output channel 16 or Digital input channel 32
10	1M	Reference potential ch 1 ... 8	20	2M	Reference potential ch 9 ... 16

Note: The digital outputs can also be used as digital inputs. This is especially important for AddFEM SOE. If the connector pins are used for digital outputs, the values of the digital inputs continue to be read to monitor the signal status of the outputs.