SIEMENS

SIMATIC

ET 200SP HF
Technology module TM FCT070

Operating Instructions

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Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION

indicates that minor personal injury can result if proper precautions are not taken.

NOTICE

indicates that property damage can result if proper precautions are not taken.

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The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

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We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Introduction 1

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

1.1 Purpose of this document

These instructions contain the product-specific information you need for connecting, commissioning, parameter assignment/addressing, diagnostics and technical specifications of the technology module.

General information on installation and commissioning of ET 200SP HF is available in the ET 200SP System Manual (https://support.industry.siemens.com/cs/ww/en/view/109742709).

1.2 Use in hazardous area

WARNING

Use in hazardous area

Risk of explosion.

- Only use equipment that is approved for use in the intended hazardous area and labeled accordingly.
- Do not use devices that have been operated outside the conditions specified for hazardous areas. If you have used the device outside the conditions for hazardous areas, make all Ex markings unrecognizable on the nameplate.

WARNING

If the device is installed in a cabinet, the inner temperature of the cabinet corresponds to the ambient temperature of the device.

WARNING

Impermissible repair of the device

- Repair must be carried out by Siemens authorized personnel only.

1.3 Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit
https://www.siemens.com/industrialsecurity.

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under
https://www.siemens.com/industrialsecurity.

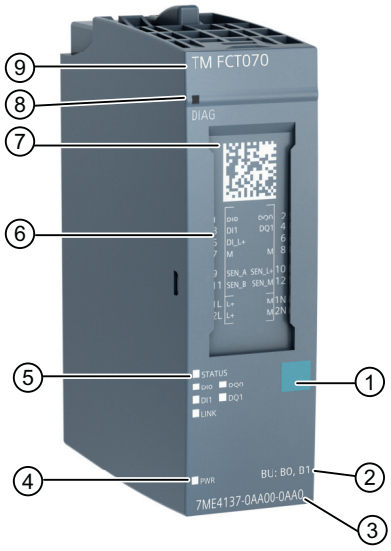
1.4 Open Source Software

Open-source software is used in the firmware of the product described. Open Source Software is provided free of charge. We are liable for the product described, including the open-source software contained in it, pursuant to the conditions applicable to the product. Siemens accepts no liability for the use of the open source software over and above the intended program sequence, or for any faults caused by modifications to the software.

For legal reasons, we are obliged to publish the original text of the license conditions and copyright notices. Please read the information on this on the *Internet* (https://support.industry.siemens.com/cs/ww/en/view/109740777).

Product overview

2



① Color coding module type
② BaseUnit type
③ Article number
④ LED for supply voltage
⑤ Status LEDs
⑥ Connection diagram
⑦ 2D-Matrix Code
⑧ LED for diagnostics
⑨ Module type and designation

Figure 2-1 View of the TM FCT070 module

See also

SIMATIC ET 200SP Distributed I/O system (https://support.industry.siemens.com/cs/ww/en/view/58649293)

SIMATIC ET 200SP Product information on the documentation of the ET 200SP distributed I/O system (https://support.industry.siemens.com/cs/ww/en/view/73021864)

2.1 Properties

The FCT070 technology module has the following properties:

- Transmitter module for one Siemens four wired digital Coriolis flowmeter
- The module works with the digital Coriolis flow sensors SITRANS FCS400 and SITRANS FCS300 or with Siemens Digital Sensor Link (FC DSL) and analog Coriolis flow sensors SITRANS FC MASS 2100 and SITRANS FC300 DN 4
- Two configurable digital inputs

- Two configurable digital outputs
- High update rate (100 Hz) on all process values
- Measurement of the following process variables:
  - Mass flow
  - Volume flow
  - Standard volume flow
  - Density
  - Medium temperature
  - Fraction
- 3 Totalizers
- Dosing functionality
- Independent low flow cut-off settings for volume flow and mass flow
- Status LEDs

Operating modes

Transmitter for Coriolis flowmeter

Transfers the measuring signals from the flowmeter via the ET 200SP HF to STEP 7 (TIA Portal or PCS 7). It is possible to read values from the flowmeter but also to write configuration data to the flowmeter.

- Dosing
  Full automatic filling process for bottle filling. The filling process can be controlled via the digital inputs. With the outputs a fast and slow filling valve can be controlled. The dosing process can be also controlled via STEP 7 (TIA Portal).
  - 2 x digital input
    Digital input 1 and 2 for start, stop, resume and pause
  - 2 x digital output
    Digital output 1 for control valve one
    Digital output 2 for control valve two
- Status signal flow direction with a digital output
  Flow direction forward (off) or backward (on)

Configuration

SITRANS TM FCT070 configuration software options:

- TIA Portal V16 or higher SP1 with HSP 0331 (Hardware Support Package from the Internet)
- STEP 7 version V5.6 or higher SP2 with HSP 0303

- PCS 7 V9.0 SP3 or higher (download driver from PCS 7 Library)
- GSD file links:
  - PROFINET GSD files (https://support.industry.siemens.com/cs/document/57138621?dti=0&lc=en-US)

Firmware update

Firmware updates can be downloaded to the memory of the SITRANS TM FCT070 module by means of the STEP 7 Basic (TIA Portal) engineering software or STEP 7 - HW Config.

See also

PROFIBUS GSD files (https://support.industry.siemens.com/cs/document/73016883?dti=0&lc=en-US)

Modes and Functions

3

3.1 Overview

Modes and functions

The TM FCT070 has two digital inputs and two digital outputs. You can assign a different mode for each in-/output.

Configuration of the operating mode is made using the TIA Portal or HW Config.

You can select one of the following operating modes:

- Status output
- Dosing on/off signal

Interfaces to the control program and the process under control

The TM FCT070 has the following I/O BaseUnit pin connections to the process under control:

- DI0 (digital input 0)
- DQ0 (digital output 0)
- DI1 (digital input 1)
- DQ1 (digital output 1)

3.2 Cut-off limits

The cut-off limits are used to suppress low flow rates.

It is possible to program the cut-off limit for mass flow, volume flow and standard volume flow.

In certain applications, as for instance dosing applications, 0% flow signals below a certain flowrate are desired. In these applications, the flow signal can be forced to zero, when the flow is lower than a predefined flow value (Low Flow Cut-Off). The device provides two parameters for setting the low flow cut-off:

- Low Mass Flow Cut-Off
- Low Volume Flow Cut-Off

Parameterization

The mode of the cut-off limits can be set via the Parameter data record (Page 65).

Byte Bit		Cut-off limit
	Mass flow cut-off limit	encoded as Float32 in mass units Default value = 0.0
	Volume flow cut-off limit	encoded as Float32 in volume units Default value = 0.0

3.3 Zero point adjustment

Note

Preconditions

Before a zero point adjustment is initiated, the sensor pipe must be flushed, filled and at an absolute flowrate of zero preferably also at operating pressure and temperature.

Note

Change of parameters during zero point adjustment

Do not change any other parameter during the zero point adjustment procedure.

Automatic zero point adjustment

The device measures and calculates the correct zero point automatically.

The automatic zero point adjustment of the flowmeter is set by the following parameters:

- Duration
- Start Zero Point Adjustment

When zero adjust is initiated by selecting "Start Zero Point Adjustment", the mass flow values are acquired and totalized for the configured period (Duration). The default zero point adjustment period (30 s.) is normally sufficient for a stable zero point measurement.

Note

Extremely low flow quantity

If the flow quantity is extremely small, extremely precise measurement is necessary. In this case, a long zero point adjustment period can be selected for improved zero point adjustment.

3.4 Digital output mode DQ0/DQ1

The TM FCT070 outputs offer different signals at the DQ0/DQ1 digital outputs.

The digital output can be used for status signals, flow direction or for control of valves in the dosing mode.

Parameterization

The mode of the outputs DQ0 and DQ1 can be set via the Parameter data record (Page 65).

3.4.1 Status signal

Output mode must be set to 1 to activate signal. Depending on the activation one or more status signals can be shown.

Status signal can show following status at DQ0 or/and DQ1:

- out of specification – measuring signal is out of range
- failure – sensor measuring failure
- maintenance required – the sensor needs maintenance
- function check – e.g. startup of the sensor, simulation active, force mode activated or frozen value active

3.4.2 Force value

Activates the output if force output is set at the input DI0 or DI1.

Possible with Step7 (TIA Portal) or activation via I/O data.

3.4.3 Flow direction

Displays the flow direction:

- Active: positive flow
- Inactive: negative flow

3.5 Digital input mode DI0/DI1

The TM FCT070 input can handle different signals at the DI0 and DI1 digital inputs.

Parameterization

The mode of the digital inputs DI0 and DI1 can be set via the Parameter data record (Page 65).

Following modes are available

Dosing

- Dosing function
- Start dosing on leading edge
- Stop dosing on leading edge
- Pause/resume dosing

Totalizer function

- Reset totalizer 1 on leading edge
- Reset totalizer 2 on leading edge
- Reset totalizer 3 on leading edge
- Reset all totalizers on leading edge
- Start/stop totalizer 1
- Start/stop totalizer 2
- Start/stop totalizer 3

Special functions

Force outputs is used to switch on both outputs. It can be used e.g. for a cleaning process

- Freeze process values
- Force outputs
- Zero adjust on leading edge

3.5.1 Function: Dosing

The TM FCT070 offers a dosing operation mode. The dosing mode can be used for filling processes, with control of one or two on/off valves and optional one or integrated two inputs for start, stop, pause and resume. The open and close of the second valve can be adjusted depending on the filling level. This valve is normally used for the fast filling.

Is the target dosing amount reached, the valves are closed.

The filling process can be controlled via STEP 7 (TIA Portal) or in- and outputs which are integrated in the FCT070 module. The control and function of the dosing process is determined by the configuration.

Parameterization

The dosing mode can be set via the Parameter data record (Page 65).

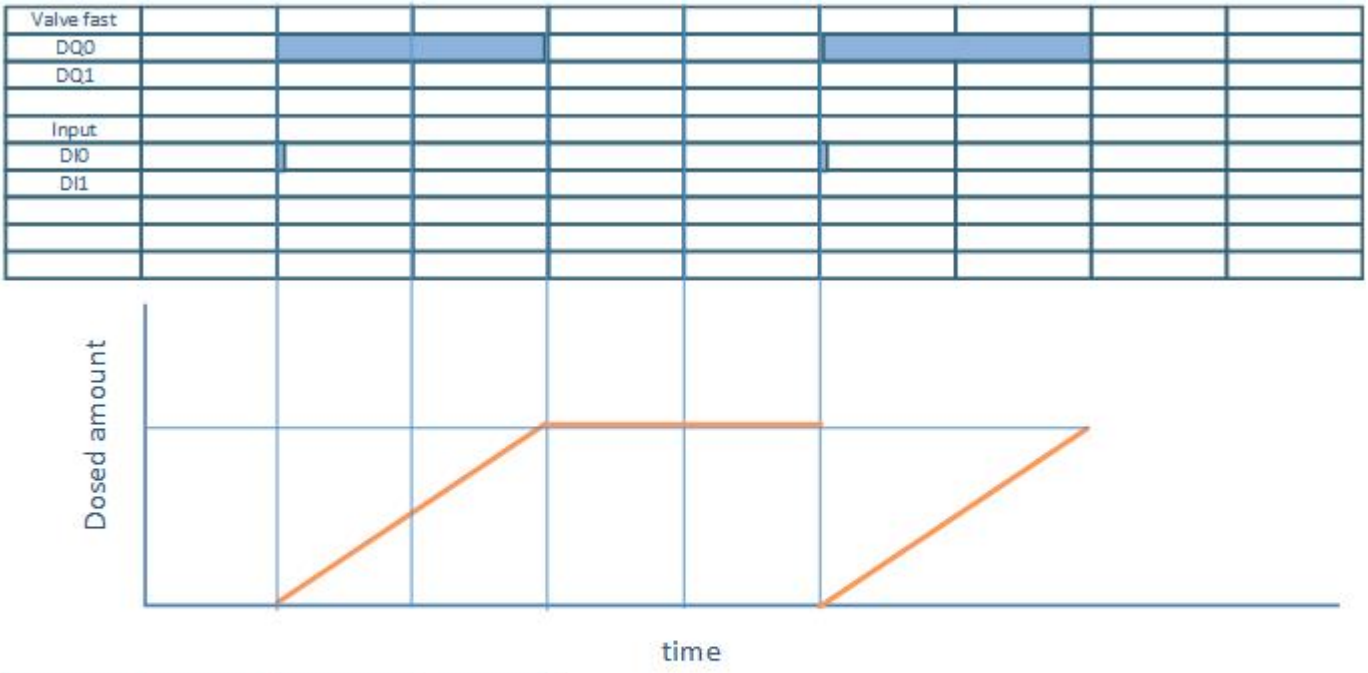
With the inputs DI0, DI1, and outputs DQ0 and DQ1 the customer can build a PLC independent dosing filling control process.

Output DQ0 low flow filling valve (main valve)

Output DQ1 fast flow filling valve

3.5.1.1 Filling with one valve

- DQ0 filling valve
- DI0 start signal of dosing



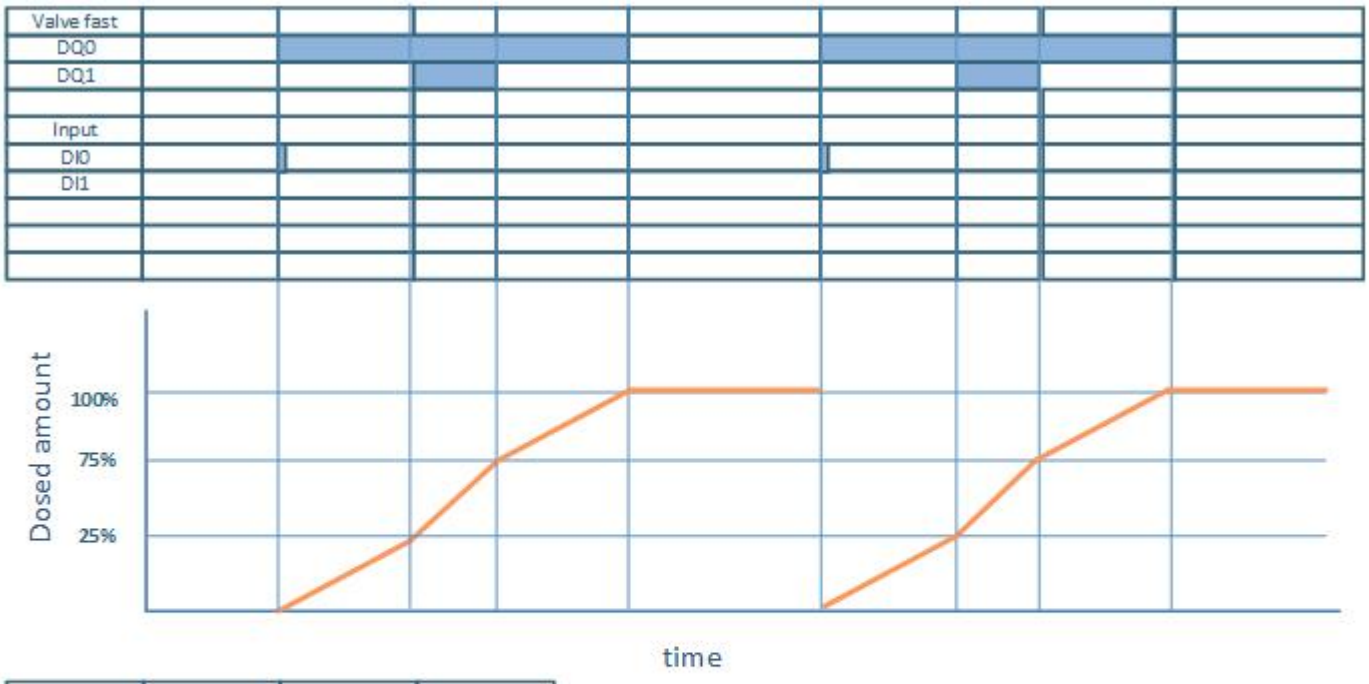
Dosing mode	1	one valve	
Target dosing amount		individual	
Mode input			
DI0	1	Start dosing	
DI1	0	No function	

3.5.1.2 Filling with two valves and external start

The maximum dosing amount can be determined depending on address 45.

Dosing amount DQ1 open and DQ1 close allows to adjust the filling range of the second valve.

- DQ0 low flow filling valve
- DQ1 fast flow filling valve
- DI0 start signal of the dosing



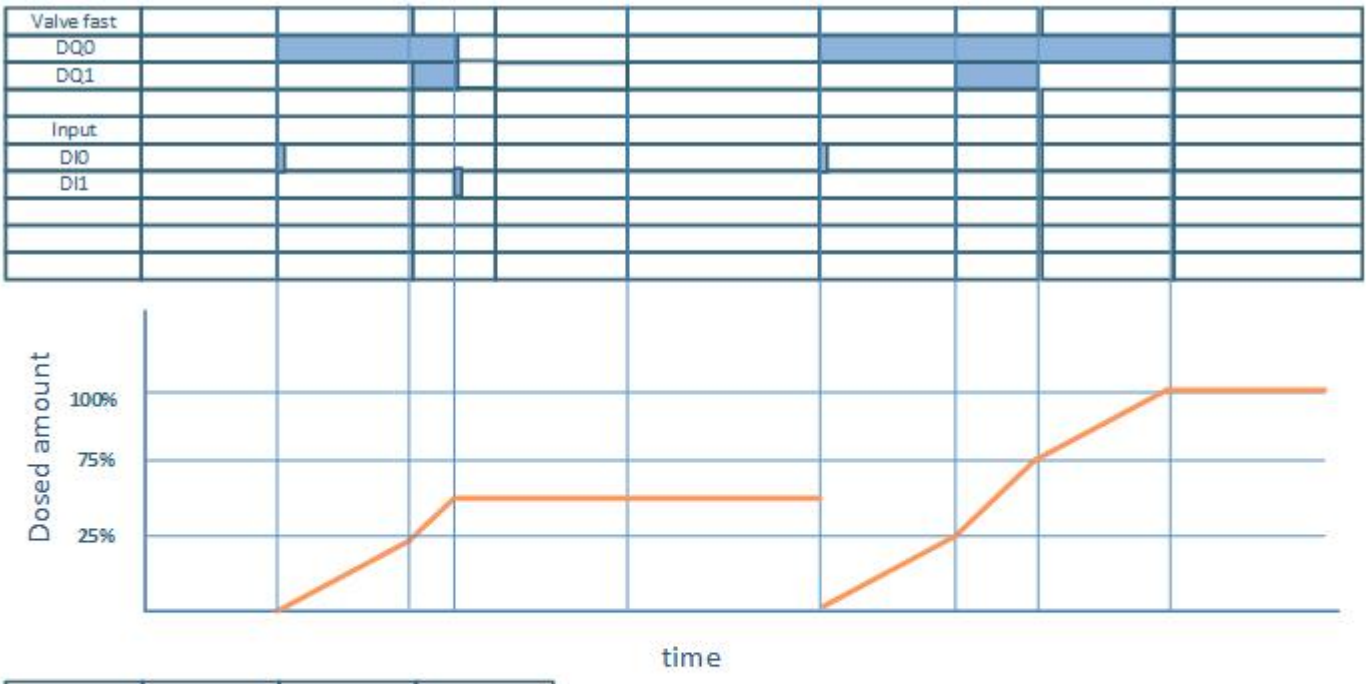
Dosing mode	2	two valves	
Target dosing amount		individual	
Mode input			
DI0	1	Start dosing	
DI1	0	No function	
Target dosing amount			
DQ1 close	75%		
DQ1 open	25%		

3.5.1.3 Filling with two valves and stop filling procedure

Stop signal via input DI1.

- DQ0 low flow filling valve
- DQ1 fast flow filling valve
- DI0 start signal for dosing
- DI1 stop signal for dosing

Signal only resumes when starting.



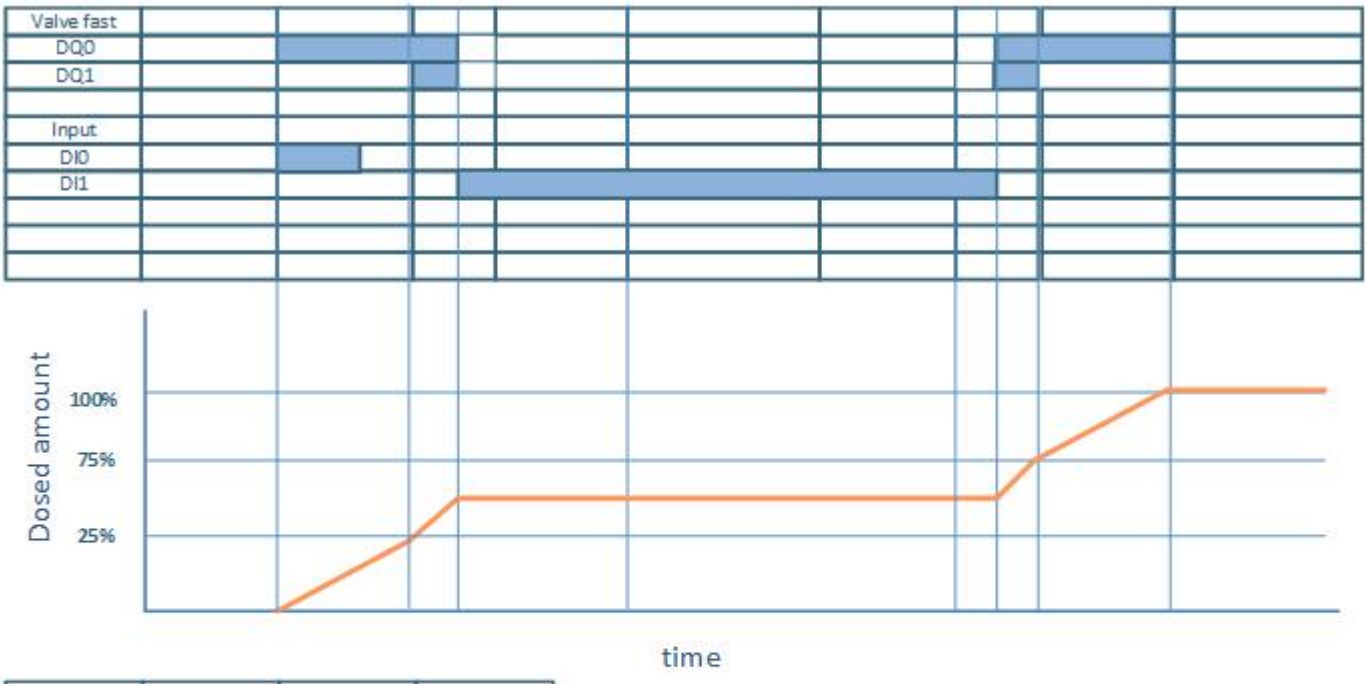
Dosing mode	2	two valves	
Target dosing amount		individual	
Mode input			
DI0	1	Start dosing	
DI1	2	Stop dosing	
Target dosing amount			
DQ1 close	75%		
DQ1 open	25%		

The stop signal can be sent, depending on the setup, via STEP 7 (TIA Portal) or external input.

3.5.1.4 Filling with two valves and interrupt filling procedure

Stop signal via input DI1.

- DQ0 low flow filling valve
- DQ1 fast flow filling valve
- DI0 start signal for dosing
- DI1 pause/resume signal for dosing



Dosing mode	2	two valves	
Target dosing amount		individual	
Mode input			
DI0	1	Start dosing	
DI1	8	Pause dosing	
Target dosing amount			
DQ1 close	75%		
DQ1 open	25%		

The pause signal can be sent, depending on the setup, via STEP 7 (TIA Portal) or external input.

3.5.2 Function: Totalizer

Definition

The TM FCT070 has a different totalizer integrated. The totalizer counts the volume and can be used for process control. The counting is done in the FCT070 and can be used in the PLC or shown on TIA Portal.

The reset of the totalizers can be done via STEP 7 (TIA Portal) or with the input DI0 or DI1.

Parameterization

The mode of the totalizer can be set via the Parameter data record (Page 65).

Depending on the mode set for the DI0/DI1 inputs, the totalizer can be started, stopped or reset with the inputs on the FCT070.

In case of failure in the system, the totalizer holds the last value before the failure occurred.

3.5.2.1 Freeze process values

Definition

The mode of the totalizer can be set via the Parameter data record (Page 65).

Is mode of DI0 or DI1 set to 10.

With the input the process values of the measuring value can be frozen to have a fixed measuring value for testing the PLC programming during commissioning.

3.5.2.2 Force outputs

Definition

The mode of the totalizer can be set via the Parameter data record (Page 65).

Is mode of DI0 or DI1 set to 9.

The inputs DI0 or DI1 can control the outputs DQ0 and DQ1 and switch them on and off.

To activate the outputs with the inputs the function DQ0 or DQ1 force value must be set to active.

3.5.2.3 Zero adjust on leading edge

Definition

The mode of the totalizer can be set via the Parameter data record (Page 65).

Is mode of DI0 or DI1 set to 7.

A zero-point adjustment of the flowmeter measuring is done. The actual measured flow value is set to zero when triggered.

Installation

4

4.1 Basic safety notes for ordinary location (electrical safety FM, UL)

⚠ WARNING

If a device is operated in an ambient temperature of more than 50 to 60 °C, the temperature of the device housing may be higher than 70 °C. The device must therefore be installed so that it is only accessible to service personnel or users that are aware of the reason for restricted access and the required safety measures at an ambient temperature higher than 60 °C.

⚠ WARNING

Open equipment

The devices are "open equipment" according to the standard IEC 61010-2-201 or UL 61010-2-201 / CSA C22.2 No. 61010-2-201. To fulfill requirements for safe operation with regard to mechanical stability, flame retardation, stability, and protection against contact, the following alternative types of installation are specified:

- Installation in a suitable cabinet.
- Installation in a suitable enclosure.
- Installation in a suitably equipped, enclosed control room.

4.1.1 Specific conditions for use in hazardous locations (ATEX, IECEx, UL)

⚠ WARNING

Incorrect installation

Risk of explosion in the hazardous area. For use in hazardous areas according to Class I, Division 2 or Class I, Zone 2 or for use in the EU according to ATEX 2014/34/EU, observe the following conditions:

- Install the device in a control cabinet or enclosure.
- The control cabinet or enclosure meets at least the requirements of IP54 according to IEC/EN 60079-7 and pollution degree 2 or better according to IEC/EN 60664-1.

Note

You must not install the device on a wall in hazardous areas.

⚠ WARNING

Take measures to prevent transient voltage surges of more than 40% of the rated voltage. This is the case if you only operate devices with SELV (safety extra-low voltage).

⚠ WARNING

Explosion hazard

Do not disconnect equipment when a flammable or combustible atmosphere is present.

⚠ WARNING

Substitution of components may impair suitability for Division 2.

This equipment is suitable only for use in Class I, Division 2, Groups A, B, C and D, Class I, Zone 2, Group IIC or non-hazardous locations.

4.1.2 Notes for use in hazardous areas according to FM

⚠ WARNING

Substitution of components may impair suitability for Division 2.

⚠ WARNING

Explosion hazard

Do not disconnect equipment when a flammable or combustible atmosphere is present.

⚠ WARNING

WARNING – EXPLOSION HAZARD:

DO NOT CONNECT OR DISCONNECT EQUIPMENT WHEN A FLAMMABLE OR COMBUSTIBLE ATMOSPHERE IS PRESENT.

⚠ CAUTION

Accessible hot surfaces

⚠ CAUTION
To prevent injury, read the manual before use.

This equipment is suitable only for use in Class I, Division 2, Groups A, B, C and D, Class I, Zone 2, Group IIC or non-hazardous locations.

This equipment is suitable only for use in Class I, Zone 2, Group IIC or non-hazardous locations.

4.2 Mounting on the SIMATIC ET 200SP HF

Only use the technology module FCT070 in conjunction with a SIMATIC ET 200SP HF distributed I/O system. Install the technology module in a control cabinet. Observe the information on the protection class and degree of pollution in the section Technical data (Page 45).

When installing the SIMATIC components with the technology module described herein, follow the setup, assembly and wiring guidelines for the SIMATIC ET 200SP HF. See system manual (https://support.industry.siemens.com/cs/ww/en/view/109742709) for the SIMATIC ET 200SP HF.

The technology module FCT070 is snapped onto the SIMATIC ET 200SP HF BaseUnit B0 (BU20-P12+A4+0B, order number 6ES7193-6BP20-0BB0) or B1 (BU20-P12+A0+4B, order number 6ES7193-6BP20-0BB1).

All information about connecting is available in section Connecting (Page 31).

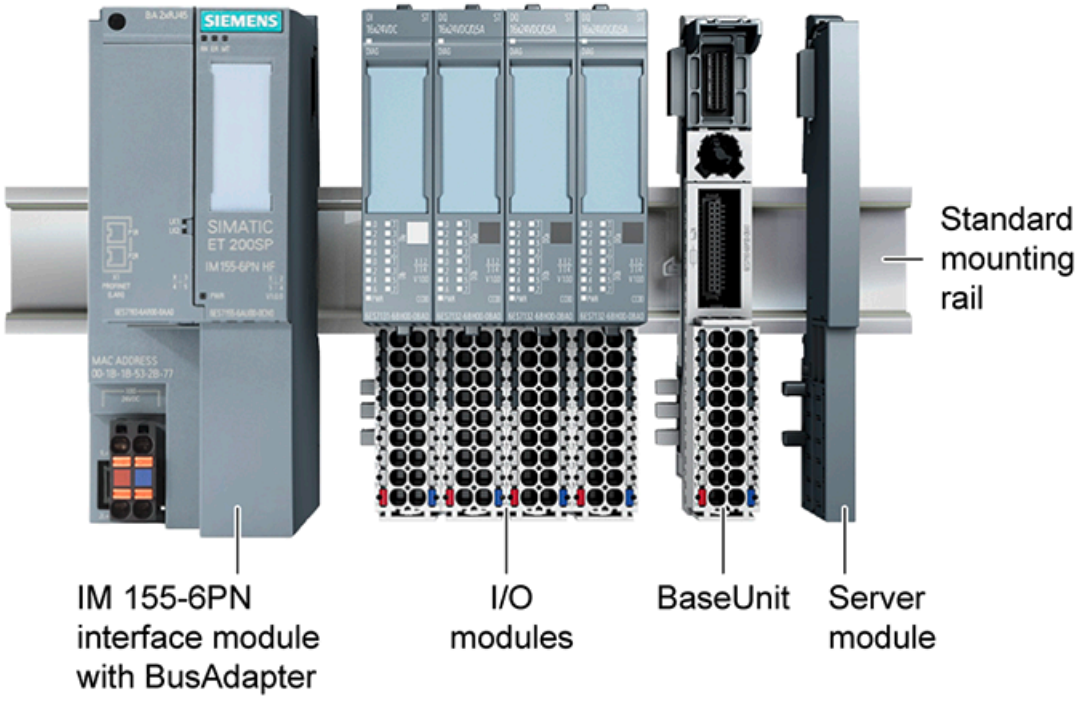
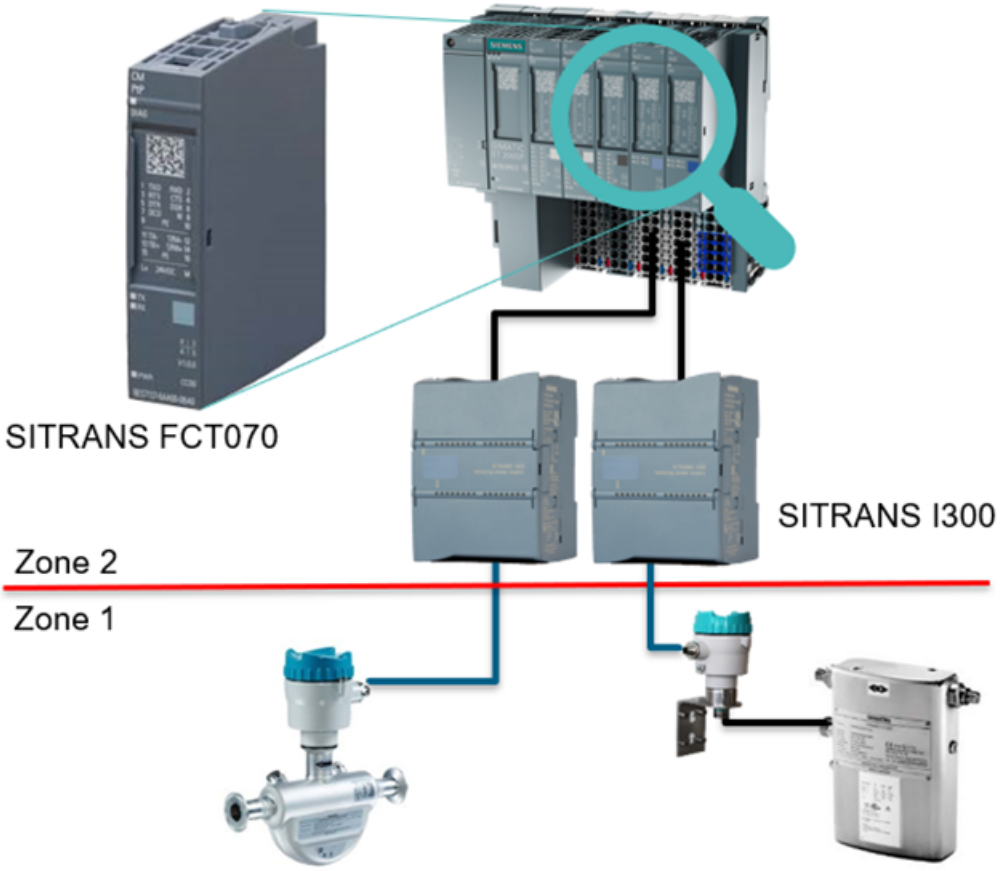


Figure 4-1 Mounting on the SIMATIC ET 200SP HF

4.3 Installing FCT070 with isolating power supply

To use the sensor in explosion proof areas an isolating power supply must be installed. The SITRANS I300 can be used to isolate the power supply and the digital communication signal to the sensor.



NOTICE
Transmission speed Change the transmission speed of the SITRANS I300 from standard to 460,8 kBit/s.

- **Sensor in Zone 1 or division 1 and ET 200SP HF in Zone 2 or division 2**
  I300 is needed.

  Note

  If the version of the FC DSL contains the "For Ex-d", it is possible to connect the FC DSL via Ex-d-cable-gland or conduit-stop to the FCT070 without I300.

- **Sensor in Zone 2 and ET 200SP HF in Zone 2**
  I300 is needed.

  Note

  If the version of the FC DSL contains the "For Ex-d", it is possible to connect the FC DSL via Ex-d-cable-gland or conduit-stop to the FCT070 without I300.

Note

NOT POSSIBLE: Sensor in Zone 1 or division 1 and ET 200SP HF in Zone 1 or division 1

Note

If sensor and FC DSL are divided, it is possible (in some cases) to install sensor in Zone 0.

4.4 EMC-compliant installation

4.4.1 Introduction

Overview

The technology module described here was developed for use in industrial environments and complies with high EMC requirements. Nevertheless, before installing your devices you should prepare an EMC plan and identify and take into consideration possible interference sources.

EMC

EMC (electromagnetic compatibility) describes the capability of electrical equipment to operate without errors in a given electromagnetic environment, without being subject to external influence and without influencing external devices in any way.

4.4.2 Possible effects of interference

Electromagnetic interferences can influence the technology module described here in various ways:

- Electromagnetic fields having a direct influence on the system
- Interferences transported by communication cables
- Interferences having an effect via process cables
- Interferences entering the system via the power supply and/or protective ground

Interferences can impair the fault-free functioning of the technology module.

4.4.3 Coupling mechanisms

Depending on the propagation medium (conducted or non-conducted) and the distance between the interference source and the device, interferences can enter the faulty device through four different coupling mechanisms:

- Electrical coupling
- Capacitive coupling
- Inductive coupling
- Radiation coupling

4.4.4 Five basic rules for securing EMC

Observe these five basic rules to secure EMC.

Rule 1: Large area grounding contact

- When installing the devices, make sure that the surfaces of inactive metal parts are properly bonded to chassis ground (see following sections).
- Bond all inactive metal parts to chassis ground, ensuring large area and low-impedance contact (large cross-sections).
- When using screw connections on varnished or anodized metal parts, support contact with special contact washers or remove the protective insulating finish on the points of contact.
- Wherever possible, avoid the use of aluminum parts for ground bonding. Aluminum oxidizes very easily and is therefore less suitable for ground bonding.
- Provide a central connection between chassis ground and the ground/protective conductor system.

Rule 2: Proper cable routing

- Organize your wiring system into cable groups (high-voltage/power supply/signal/ measurement/data cables).
- Always route high-voltage and data cables in separate ducts or in separate bundles.
- Install the measurement cables as close as possible to grounded surfaces (e.g. supporting beans, metal rails, steel cabinet walls).

Rule 3: Fixing the cable shielding

- Ensure proper fixation of the cable shielding.
- Always use shielded data cables. Always connect both ends of the data cable shielding to ground on a large area.
- Keep unshielded cable ends as short as possible.
- Always use metal/metalized connector housings only for shielded data cables.

Rule 4: Special EMC measures

- All inductors that are to be controlled should be connected with suppressors.
- For cabinet or enclosure lighting in the immediate range of your controller, use incandescent lamps or interference suppressed fluorescent lamps.

Rule 5: Homogeneous reference potential

- Create a homogeneous reference potential and ground all electrical equipment.
- Use sufficiently dimensioned equipotential bonding conductors if potential differences exist or are expected between your system components. Equipotential bonding is absolutely mandatory for applications in hazardous areas.

Connecting 5

5.1 Basic safety notes for ordinary locations (electrtical safety FM, UL)

5.1.1 Safety extra low voltage

⚠ WARNING

Safety extra low voltage

The equipment is designed for operation with Safety Extra-Low Voltage (SELV) by a Limited Power Source (LPS). (This does not apply to 100 V...240 V devices.)

The power supply unit for the equipment power supply must comply with NEC Class 2, as described by the National Electrical Code (r) (ANSI / NFPA 70).

There is an additional requirement if devices are operated with a redundant power supply:

If the equipment is connected to a redundant power supply (two separate power supplies), both must meet these requirements.

⚠ WARNING

Suitable cables at high ambient temperatures

If the temperature of the cable or housing socket exceeds 70 °C or the branching point of conductors exceeds 80 °C, special precautions must be taken.

If the device is operated at ambient temperatures of between 50 °C and 60 °C, only use cables with a maximum permitted operating temperature of at least 80 °C.

5.1.2 Special conditions for use in hazardous locations (ATEX; IECEx, FM, UL)

⚠ WARNING

WARNING – EXPLOSION HAZARD:

DO NOT CONNECT OR DISCONNECT EQUIPMENT WHEN A FLAMMABLE OR COMBUSTIBLE ATMOSPHERE IS PRESENT.

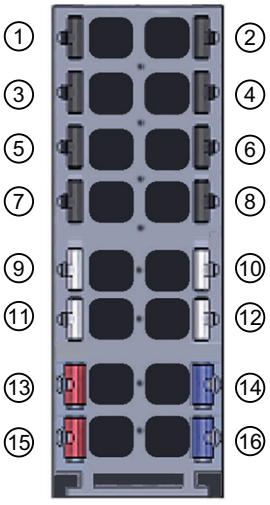
WARNING

Take measures to prevent transient voltage surges of more than 40% of the rated voltage. This is the case if you only operate devices with SELV (safety extra-low voltage or Class 2 power supply).

5.2 Connection of inputs and outputs

The FCT070 has two digital inputs and two digital outputs which can be configured for different operation modes.

Table 5-1 Pin assignment of the BaseUnit

Naming	Con.	PIN	BaseUnit BU20	PIN	Con.	Naming
Digital input	DI0	1		2	DQ0	Digital output
Digital input	DI1	3		4	DQ1	Digital output
+24 V DC supply voltage for digital inputs	DI_L+	5		6	nc	
Ground for digital outputs	M	7		8	M	Ground for digital outputs
RS-485 data line B for SEN communication	SEN_B	9		10	SEN_L+	+15 V DC supply voltage for SEN
RS-485 data line A for SEN communication	SEN_A	11		12	SEN_M	GND for SEN supply
+24 V DC supply voltage	L+	13		14	M	Ground for supply voltage
	L+	15		16	M	

Digital outputs			Voltage switching load
Digital output DQ0	Control valve 1 or Status signal output or Flow direction indication depending on DQ0 mode	Active output	24 VDC 100 mA
Digital output DQ1	Control valve 2 or Status signal output or Flow direction indication depending on DQ1 mode	Active output	24 VDC 100 mA

Digital inputs			**Voltage**
Digital input DI0	Dosing, totalizer or special function	signal "0" 0 to +5V signal "1" +15 to +30V	24 VDC
Digital input DI1	Dosing, totalizer or special function	signal "0" 0 to +5V signal "1" +15 to +30V	24 VDC

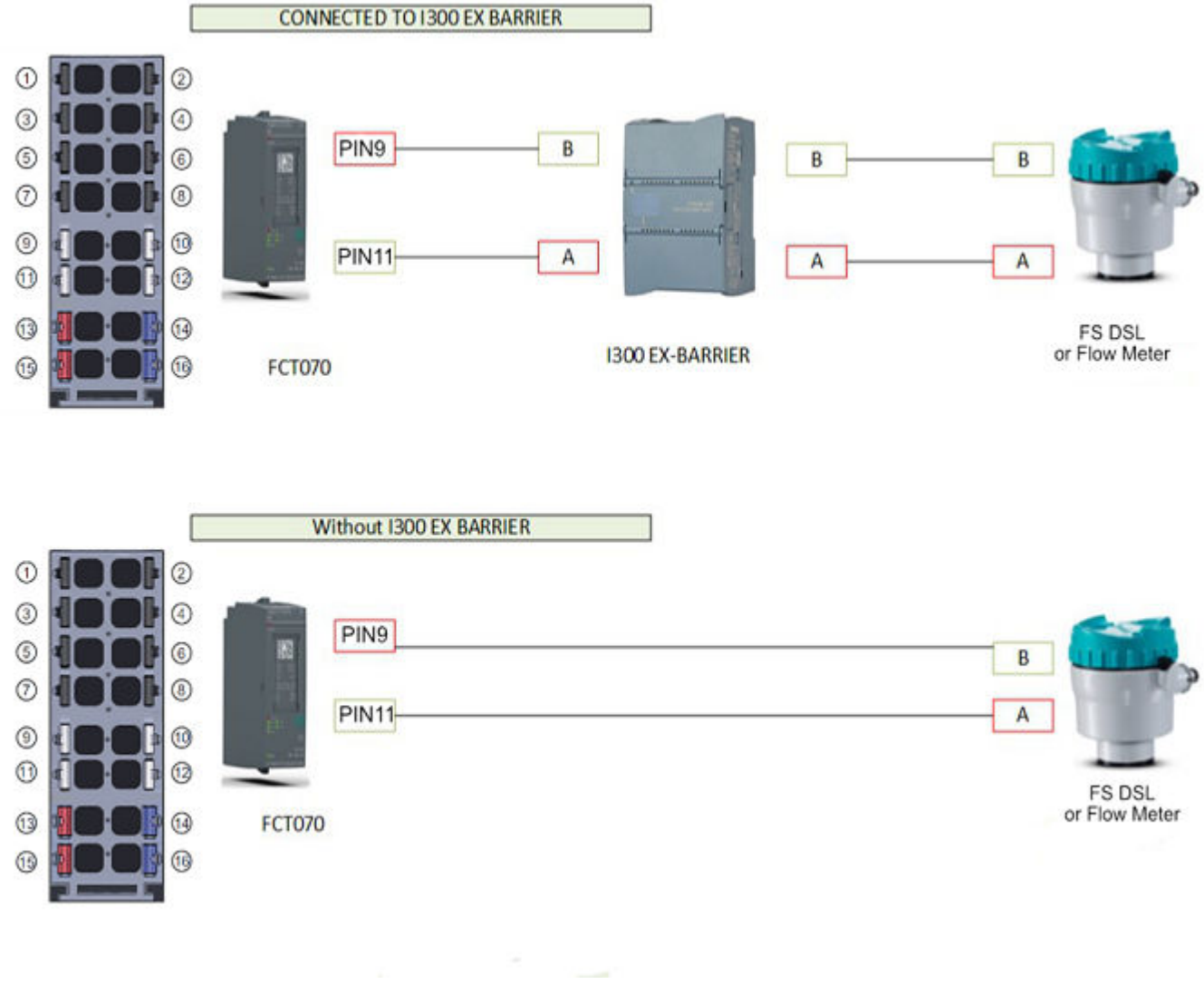
WARNING

Supply voltage M connections

Connect both the M potential pins to the power supply return with separate wires. If one wire breaks, then the other wire maintains the electrical connection from M to the power supply return.

If the electrical connection between the M potential and the power supply return is broken, then unexpected conditions can occur and the digital outputs may go high even though your program is not setting a high state.

Connecting with or without SITRANS I300 Ex barrier



Note

L+ and M isolation on TM FCT070 module using BaseUnit type B0 or B1

The L+ and M connections on the type B1 BaseUnit are electrically isolated, from adjacent BaseUnits plugged in on the left-side or right-side. The L+ and M power bus passes through the BaseUnit type B0 or B1 (with no connections) and extends the power bus to connect left-side and right-side BaseUnits.

Note

Electromagnetic interference shielding for inputs

Input connections on the BaseUnit type B0 or B1 used by the TM FCT070 module do not have shield ground connections. You must connect cable shields to electrical ground at the DIN rail or the system cabinet.

Example installation of the dosing system

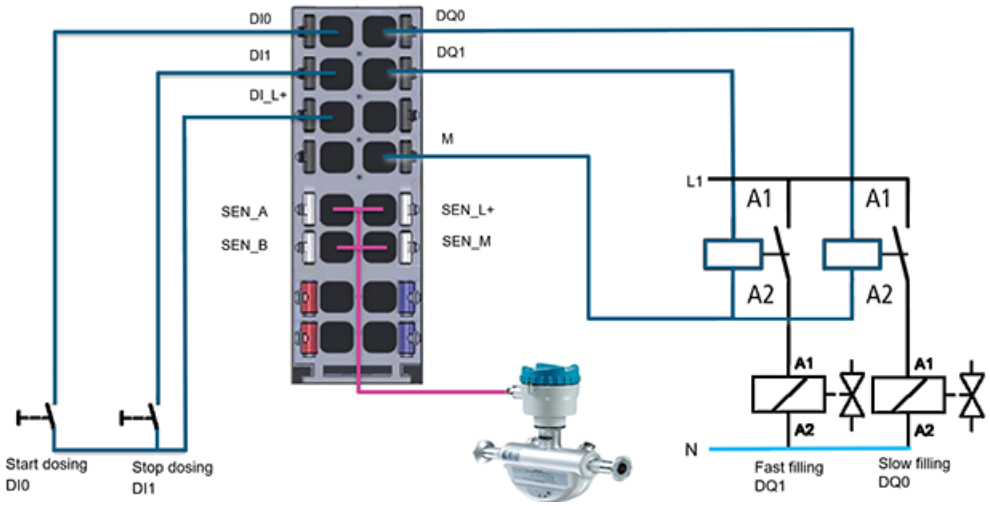


Figure 5-1 Connection of the dosing system

Note

The digital output switch-off response / switch-off edge depends on the load. Thus, it is possible that very short pulses cannot be output correctly.

Note

Relays and contactors can be connected direct without external circuitry.

5.3 Start-up of FCT070

Introduction

The first connection and start-up of a new sensor has a plug and play function.

The connection of the sensor is done via the SSL cable. All sensor calibration data are automatically transferred during the first startup from the sensor to the TM FCT070 and stored in the TM FCT070 memory.

Starting up

1. Connect the sensor via the SSL cable.
2. Connect the power supply.
   The sensor data are transferred automatically from the sensor to the TM FCT070.
   The red STATUS LED flashes during start up.
   The green LINK LED is on when the sensor is connected.

Configuring

6

6.1 Configuration software

Introduction

The TM FCT070 module is configured and assigned parameters with the GSD file.

For service TM FCT070 has a special service port on board.

System environment

The technology module can be used in the following system environments:

Table 6-1 Applications of the technology module with PROFINET I/O

Applications	Components required	Configuration software	In your program
Decentralized operation in an S7-1500 system	• S7-1500 automation system • ET 200SP HF decentralized I/O system • TM FCT070	STEP 7 (TIA Portal): Device configuration and parameter settings with HSP	Direct access to the control and feedback interface of the TM FCT070 in the I/O data
Centralized or decentralized operation in an ET 200SP HF system	• ET 200SP HF automation system • TM FCT070	STEP 7 (TIA Portal): Device configuration and parameter settings with HSP	Direct access to the control and feedback interface of the TM FCT070 in the I/O data
Decentralized operation in an S7-300/400 system	• S7-300/400 automation system • ET 200SP HF decentralized I/O system • TM FCT070	STEP 7 (TIA Portal): Device configuration and parameter settings with HSP STEP 7: Device configuration and parameter settings with hardware configuration (HWCN)	Direct access to the control and feedback interface of the TM FCT070 in the I/O data
Decentralized operation in a PROFINET controller	PROFINET controller • ET 200SP HF decentralized I/O system • TM FCT070	Engineering system with GSD file	Direct access to the control and feedback interface of the TM FCT070 in the I/O data

6.2 Configuration overview

You can use the STEP 7 (TIA Portal) or STEP 7 hardware configuration to set these parameters. Also, you can change the parameter assignment at runtime with your program using data record 128 (Page 65).

STEP 7 (TIA Portal) and STEP 7 assist you during parameter assignment by disabling keyboard input for invalid parameters and range checking your value assignments. Depending on previous parameter selections, other options will be disabled. For example, if you select the one channel operation (the parallel connection of the two output channels), then the parameter options for channel two and high-speed output are disabled.

When you make a runtime parameter assignment that uses the WRREC (Write Record) instruction to modify data record 128, you must ensure that you do not attempt to write an invalid record data. WRREC execution with invalid data fails and returns error code. For example, if you are using one channel operation and include parameter data for two channels, then the record length is too long and WRREC execution fails.

If you use STEP 7 (TIA Portal), you can find the module in the Hardware catalog under "Technology Modules". If you use STEP 7, you can find the module following installation of the corresponding HSP file in the Hardware catalog.

The following table shows how a channel's "Parameter" group is affected by mode selection.

6.3 Address space

Address space of the technology module

Table 6-2 TM FCT070 I/O address space usage

Function	Byte output	Byte input
Address space	83 byte fix	7 byte

6.4 TIA portal Device configuration

Drag the TM FCT070 module from the hardware catalog and drop it in a rack image. The example rack below uses the TM FCT070 module in a decentralized I/O system. When you click on the TM FCT070 image in a rack, a blue line highlights the module and you can set parameters that appear on the Properties tab.

Enter the general project and identification & maintenance information.

6.4.1 General information

Enter the general project and identification & maintenance information.

Startup

To start a new output sequence after CPU/master STOP with STS_SW_ENABLE set, first reset SW_ENABLE. Keep SW_ENABLE reset until STS_SW_ENABLE is also reset.

If the "Continue working mode" option is used, then during a change from CPU-/Master-STOP to RUN (startup), the CPU/Master cannot clear the outputs.

Possible solution: In the part of your program that is executed during startup, set the "Software enable" (SW_ENABLE = 1) control bit.

Modified parameter assignment

The status assumed by the TM FCT070 at CPU/master STOP remains even in the case of parameter assignment or configuration of the ET 200SP HF station. This occurs, for example, at POWER ON of the CPU/master, or the IM 155-6, or at the resumption of DP transfer.

In "Continue working mode", however, and after loading changed parameters or configuration of the ET 200SP HF station to the CPU/master, the TM FCT070 terminates the process. As a result, the TM FCT070 resets the DQ digital outputs.

6.4.2 I/O addresses

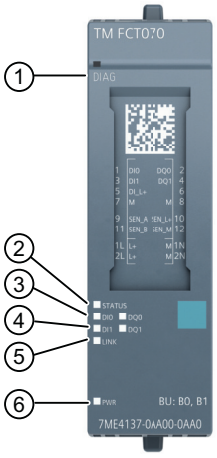
You can assign the base addresses for the control interface (output addresses) and the feedback interface (input addresses). Your program logic uses the values stored in these addresses to control the TM FCT070 output and read feedback signals from the module. For details see IO data (Page 61).

Interrupts/diagnostic messages

7

7.1 Status and error displays

TM FCT070 front view



①	DIAG	green/red
②	STATUS	green/red
③	DI0, DQ0	green
④	DI1, DQ1	green
⑤	LINK	green
⑥	PWR	green

LED status display

The following tables explain the meaning of the status and error displays. Refer to Error correction and diagnostics (Page 44) for details.

Table 7-1 DIAG LED

DIAG LED	Meaning	To correct or avoid errors
□ Off	Backplane bus supply of the ET 200SP HF not OK	Check or switch On the supply voltage of the head station. Ensure the TM FCT070 is correctly inserted in the BaseUnit.
☼ Flashes green	Technology Module not configured	

DIAG LED	Meaning	To correct or avoid errors
■ On green	Technology Module configured and no module error exists	
☼ Flashes red	Technology Module configured and module diagnostics (at least one error pending) Note:	Evaluate the diagnostic alarms and eliminate the error.

Note

The DIAG LED only shows an error if the Diagnostic alarm is activated during device configuration. By default, the Diagnostic alarm is not activated.

Table 7-2 PWR LED status

PWR	Meaning	To correct or avoid errors
□ Off	No supply voltage	• Check the external 24 V DC power supply voltage connected between L+ and M.
■ On green	Supply voltage is present and OK	

Table 7-3 STATUS LED

STATUS	Error code	Meaning	Description	To correct or avoid errors
Off		No warning No alarm		
■ On red	344	Failure	No process values from the sensor.	Check connection to Coriolis flow sensor.

STATUS	Error code	Meaning	Description	To correct or avoid errors
Flashes red 2 Hz	345	Function check	Sensor startup	Wait until the start-up is finished.
			Freezing of the process values is enabled either via a digital input or the output data.	Disable the freezing of the process values to return to normal operation.
			Forcing is enabled either via digital input or the output data.	Disable forcing to return to normal operation.
	346	Out of specification	Deviations from permissible ambient or process conditions determined by device (through self-monitoring, or warnings in device) indicate that measurement is uncertain, or deviations from set value in actuators is probably greater than expected under normal operating conditions.Process or ambient conditions could damage device or result in uncertain output.	Check ambient temperature or process conditions. If possible, relocate device.
Flash green 0.5 Hz	347	Maintenance required	Process values/Output signals are still valid. No functional restriction has been detected but maintenance is requested by the connected sensor.	Maintenance of the sensor should be planned.

The status signal is min 3 seconds available.

LINK	Meaning	To correct or avoid errors
Off	Sensor is not connected with TM FCT070.	
On green	Sensor is connected correctly to TM FCT070.	

Table 7-4 DQ0 status LED

DQ0	Meaning	To correct or avoid errors
Off	DQ0 is switched off.	Check connection.
On green	DQ0 is switched on (+ 24V).	

Table 7-5 DQ1 status LED

DQ1	Meaning	To correct or avoid errors
□ Off	DQ1 is switched off.	Check connection.
■ On green	DQ1 is switched on (+ 24V).	

Table 7-6 DI0 status LED

DI0	Meaning	To correct or avoid errors
□ Off	Low level signal at input DI0.	0V at the input
■ On green	High level Input signal at DI0.	24V at the input

Table 7-7 DI1 status LED

DI1	Meaning	To correct or avoid errors
□ Off	Low level signal at input DI1.	0V at the input
■ On green	High level Input signal at DI1.	24V at the input

7.2 Error detection and diagnostics

Diagnostic alarms

When a TM FCT070 error event triggers a diagnostic alarm, the following happens:

- The DIAG light flashes red when a diagnostics alarm is pending. Once you have remedied the error, the DIAG light changes to green.
- The diagnostics are displayed as plain text in the STEP 7 (TIA Portal) online and diagnostics view.
- Options for the reaction of a CPU running your control program
  - CPU goes to STOP and interrupts processing of the user program. The diagnostic interrupt OB (for example, OB 82) is called. The event that triggered the interrupt is written in the start information of the diagnostic interrupt OB.
  - CPU remains in RUN even if no diagnostic interrupt in present in the CPU. The technology module continues working unchanged if this is possible, while the error exists.

Technical data

8

8.1 General information

Article number	7ME4138-6AA00-0BB1
General information	
Product type designation	Technology module TM FCT070
Firmware version	V1.0
FW update possible	Yes
usable BaseUnits	BU20 type B0 or B1
ET 200SP HF	yes
ET 200SP HA	compatible and tested
Color code for module-specific color identification plate	CC40
Product function	
I&M data	Yes; I&M 0
Engineering with	
• STEP 7 TIA Portal configurable/integrated as of version	V16 or higher
• STEP 7 configurable/integrated as of version	V5.5 SP4 and higher
• PCS 7	V9.0 or higher
• PROFINET as of GSD version/GSD revision	GSDML V2.34
Cable	
Maximum cable length to FC DSL	75m
Supply voltage	
Load voltage L+	24 V DC
Rated value (DC)	24 V NEC-Class II
permissible range, lower limit (DC)	19,2 V
permissible range, upper limit (DC)	28,8 V
Short-circuit protection	Yes
Reverse polarity protection	Yes; against destruction
Input current	
Current consumption, max.	500 mA
Power loss	
Typical power loss	Max. 1,7 W
Protection class	
IP protection	IP20
EMV	
Electrostatic discharge according to IEC 61000-4-2	
Field-related interference according to IEC 61000-4-3	

Article number	**7ME4138-6AA00-0BB1**
Bursted interference due to Burst according to IEC 61000-4-4	
Conducted interference by surge according to IEC 61000-4-5	
Conducted interference by high-frequency radiation according to IEC 61000-4-6	
Decentralized operation	
to SIMATIC S7-300	Yes
to SIMATIC S7-400	Yes
to SIMATIC S7-1200	Yes
to SIMATIC S7-1500	Yes
to standard PROFINET controller	Yes

Usable with the following flowmeters:

- SITRANS FCS400
- SITRANS FCS300
- SITRANS FC MASS2100 and DSL (digital sensor link)
- SITRANS FC300 and DSL (digital sensor link)
- For ATEX Zone 1 SITRANS I300 (460,8 kBits/s)

BaseUnit technical specifications

Refer to the user manual for ET 200SP BaseUnits (https://support.industry.siemens.com/cs/ww/en/view/59753521).

8.2 Digital inputs

Article number	**7ME4138-6AA00-0BB1**
Supply	24 V, max. 35 mA, short-circuit protectet
Number of digital inputs	2
Digital inputs, parameterizable	Yes
Input characteristic curve in accordance with IEC 61131, type 3	Yes
Digital input functions, parameterizable	
Freely usable digital input	Yes
Input voltage	
Type of input voltage	DC
Rated value (DC)	24 V
for signal "0"	-30 to +5 V
for signal "1"	+11 to +30 V
permissible voltage at input, min.	-30 V
permissible voltage at input, max.	30 V
Input current	

Article number	**7ME4138-6AA00-0BB1**
for signal "1", typ.	2,5 mA
Cable length	
shielded, max.	50 m; Depending on load and cable quality
unshielded, max.	25 m; Depending on load and cable quality

8.3 Digital outputs

Article number	**7ME4138-6AA00-0BB1**
Type of digital output	P- switching
Number of digital outputs	2
Current-sinking	No
Current-sourcing	Yes
Digital outputs, parameterizable	Yes
Short-circuit protection	Yes; electronic/thermal
Digital output functions, parameterizable	
Freely usable digital output	Yes
Switching capacity of the outputs	
with resistive load, max.	300 mA
on lamp load, max.	8 W
Load resistance range	
lower limit	80 Ω
upper limit	10 kΩ
Output voltage	
Type of output voltage	DC
for signal "0", max.	1 V
for signal "1", min.	23,2 V; L+ (-0.8 V)
Output current	
for signal "1" rated value	300 mA
Parallel switching of 2 outputs	Yes
Cable length	
shielded, max.[1)]	50 m; Depending on load and cable quality
unshielded, max.	25 m; Depending on load and cable quality

[1)] Shielded cable required if the cable leaves the building.

8.4 Address area

Article number	**7ME4138-6AA00-0BB1**
Assigned address area	
• Inputs	83 byte
• Outputs	7 byte

8.5 Potential separation

Article number	**7ME4138-6AA00-0BB1**
Potential separation digital inputs	
between module and backplane bus	Yes
Potential separation digital outputs	
between module and backplane bus	Yes
Potential separation channels	
between the channels	No
between the channels and backplane bus	Yes
Permissible potential difference	
between different circuits	75 V DC/60 V AC (base isolation)
Isolation	
Pollution degree	2
Maximum cable length (FC DSL - Sensor)	150m

8.6 Interrupts/diagnostics/status information

Article number	**7ME4138-6AA00-0BB1**
Substitute values connectable	Yes; Parameterizable
Alarms	
Diagnostic alarm	Yes
Diagnostic messages	
Diagnostics	Yes
Control of the power supply	Yes
Shortage	No
Overload	Yes
Diagnostics indication LED	
Monitoring of the supply voltage (PWR-LED)	Yes; green PWR LED
for sensor diagnostics	Yes; green/red STATUS LED
for module diagnostics	Yes; green/red DIAG LED

8.7 Dimensions and weight

Article number	7ME4138-6AA00-0BB1
Width	20 mm
Height	73 mm
Depth	58 mm
Weight, approx.	32 g

8.8 Electrical, EMC and climatic requirements

Article number	7ME4138-6AA00-0BB1
Product safety	
Safety regulations	IEC 61010-1:2016 ANSI/UL 61010-1:2018
Protection class	To maintain the safety characteristics of extra-low voltage circuits, external connections to communications ports, analog circuits, as well as all 24 V DC nominal power supplies and all I/O circuits must be powered by approved sources that fulfill the requirements according to the various standards for SELV, PELV, NEC Class 2, voltage limited or power limited. The ground connection for the DIN rail serves as a functional ground for dissipating interference currents.
IP degree of protection	IP 20: Protection against contact with standard probe Protection against solid bodies with diameters in excess of 12.5mm No special protection against water
Air gaps and creepage distances	Overvoltage category II Pollution degree 2
Isolation stability	Test voltage: 500 V AC or 707 V DC
Use in hazardous areas	When using the electronic weighing system in a hazardous area, observe the Special conditions for use in hazardous locations (ATEX; IECEx, FM, UL) (Page 31).
Electromagnetic compatibility	All shielded cables must be grounded at both ends to comply with the requirements for electromagnetic compatibility. If the shielded cable is routed out of the hazardous area for explosion-proof equipment, both ends of the cable shield must be connected to the potential equalization. To comply with the requirements for lightning strikes, additional measures are required for installation in Zone A according to IEC61131-2: 2007.
Electromagnetic compatibility	
Interference emission in industrial area in accordance with EN 61000-6-4	

Article number	**7ME4138-6AA00-0BB1**
Emission of radio interference (interference field strength)	Class A: Industrial environment 30 ... 230 MHz, 40 dB (mV/m) Q 230 ... 1000MHz, 47 dB (mV/m) Q -- 1 ... 3 GHz / 76 dB(mV/m) peak, 56 dB(mV/m) average 3 ... 6 GHz / 80 dB(mV/m)
Emission on power supply cables	Class A: Industrial environment 0.15 ... 0.5 MHz, 79 dB (µV) Q 0.15 ... 0.5 MHz, 66 dB (µV) M 0.5 ... 30 MHz, 73 dB (µV) Q 0.5 ... 30 MHz, 60 dB (µV) M
Interference immunity in industrial area in accordance with EN 61326-1, NAMUR NE21:2017	
Burst pulses on power supply cables (EN 6100-4-4)	±2.4 kV 5/50 ns/5 kHz ±2.4 kV 5/50 ns/100 kHz
Burst pulses on data and signal cables (EN 6100-4-4)	
Electrostatic discharge (ESD) (EN 6100-4-2)	2, 4, 6 kV direct/indirect
Electrostatic air discharge (ESD) (EN 6100-4-2)	2, 4, 6, 8 kV
Surge on power supply cables	ZONE A acc. to IEC 61131-2[1]: ±1.0 kV line to line ±2.0 kV line to earth ZONE B to IEC 61131-2: ±0.5 kV line to line ±1.0 kV line to earth
Surge on data and signal cables	ZONE A acc. to IEC 61131-2[2]: ±1.0 kV line to line ±2.0 kV line to earth ZONE B to IEC 61131-2: ±1.0 kV line to earth
Surge on data and signal cables shielded	±2.0 kV shield to ground
Surge on signal cables unshielded	0.5 kV/2kV[2]
Electromagnetic RF fields	80 MHz ... 6 GHz: 10 V/m
Induced conducted interference	10 kHz ... 80 MHz: 12 V_{eff}

[1] An external device must be provided to comply with this EMC requirement (e.g. Lightning conductor BVTAD24, Dehn & Söhne company)

[2] An external device must be provided to comply with this EMC requirement (e.g. Lightning conductor BSPM4BE24, Dehn & Söhne company)

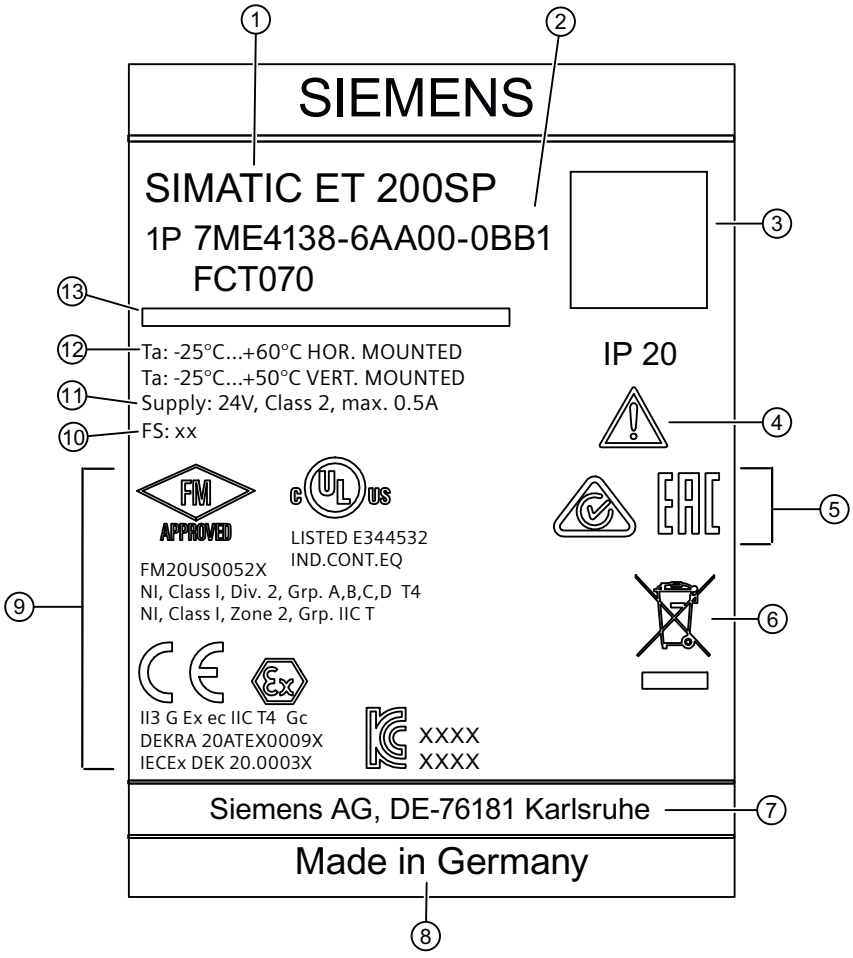
8.9 Ambient conditions

Article number	**7ME4138-6AA00-0BB1**
Ambient temperature during operation	
Minimum installation	-25 °C
horizontal installation, max.	60 °C; Observe derating
vertical installation, max.	50 °C; Observe derating
Ambient temperature during storage / transport	
Storage, min.	-40 °C
Storage, max.	70 °C
Transport, min.	-40 °C
Transport, max.	70 °C
Relative humidity	
Operation, min.	5 %
Operation, max.	95 %; no condensation
Height in operation	
Ambient air pressure altitude (relative to sea level)	Tmin ... Tmax at 1080 hPa ... 795 hPa (-1000 m ... +2000 m)

8.10 Certificates and approvals

Note

The current approvals for your device can be found on the nameplate.



① Product name
② Order number
③ QR code
④ Consult the operating instructions
⑤ Approvals
⑥ WEEE symbol
⑦ Manufacturer name and location
⑧ Manufacturing country
⑨ Approvals

II:	Group II
3:	Category 3 for use in Zone 2
G:	for gas
Ex:	Ex type of protection
IIC:	Gas group
T4:	Temperature class

⑩ Function state
⑪ Power supply
⑫ Ambient temperature range
⑬ Serial number

Figure 8-1 Example nameplate

Symbol	Standard	Marking
		→ CE approval
	Explosion protection in accordance with UL 61010-1:2012 and CAN/CSA-C22.2 No. 61010-1-12	ANSI / ISA 12.12.01 CSA C22.2 No. 213-M1987 CL. I, Div. 2 GP.A.B.C.D T4
	Explosion protection in accordance with ATEX DEKRA 20ATEX0009X EN IEC 60079-0: 2018 EN 60079-7: 2015 + A1: 2018	II 3 G Ex ec IIC T4 Gc (see certificate)
	Explosion protection in accordance with IE-CEx DEK 20.0003X IEC 60079-0: 2017 (Ed.7) IEC 60079-7: 2015 (Ed.5.1)	Ex ec IIC T4 Gc (see certificate)
		→ EAC certificate, available soon
		→ Tick mark for Australia and New Zealand
		→ KCC approval
	Explosion protection in accordance with FM (USA) FM20US0052X Class No. 3600:2018 Class No. 3611:2018 Class No. 3810:2018 ANSI/UL 61010-1:2018 ANSI/UL 121201:2017	NI, Class I, Div.2, Groups A,B,C,D T4 NI, Class I, Zone 2, Groups IIC, T4 (see certificate)

8.11 Programming reference

Control interface: 2 channels, 24 output bytes (Q addresses)

CPU input address		Description
Channel 0	**Channel 1**[1]	
DWord 0	DWord 12	Depending on the mode: • Pulse output mode: Pulse duration in µs • PWM mode: Duty cycle On-ratio (Number range set by Output format configuration) – "Per 100": 0 to 100 – "Per 1000": 0 to 1,000 – "Per 10000": 0 to 10,000 – "S7 analog output": 0 to 27,648 • PWM mode with current control: Target current is assigned as a ratio of target current/reference current • Pulse train mode: Number of pulses to output as a DWord number value between 1 to 4,294,967,295 (2^{32}-1) • On/Off-delay mode: Off-delay in µs • Frequency output mode: Output frequency in Hz
DWord 4	DWord 16	SLOT value: Behavior depends on operating mode, MODE_SLOT(1 bit), and LD_SLOT (four bits).
Byte 8: Bits 0 to 3	Byte 20: Bits 0 to 3	LD_SLOT value controls interpretation of SLOT value. • 0 = No action / idle state • 1 = Period duration µs (PWM, Pulse train, and DC motor) • 2 = On-delay µs (Pulse output, PWM, Pulse train, Frequency output, and DC motor) • 3 = Off-delay µs (On/Off-delay) • 4 = Duty cycle On-ratio (Pulse train) • 5 = Dither ramp-up time and ramp-down time (PWM) • 6 = Dither amplitude (PWM) • 7 = Dither period (PWM)
Byte 8: Bit 4	Byte 20: Bit 4	MODE_SLOT value controls the SLOT update process. • 0 = single update (SLOT changed sometimes, prior to output sequence) • 1= permanent update (SLOT controlled continuously)
Byte 9: Bit 0	Byte 21: Bit 0	SW_ENABLE: Transition from 0 → 1 and remaining 1 during the input delay starts the output sequence. Only active for the first positive edge, additional positive edges are ignored and no start occurs.
Byte 9: Bit 1	Byte 21: Bit 1	TM_CTRL_DQ: Set DQ output source: Selects either CPU program or module's output sequence. • 0 = DQn.A and DQn.B are controlled by the CPU (in your program) using the SET_DQA and SET_DQB control bits. • 1 = DQn.A and DQn.B are controlled by the module's output sequence.
Byte 9: Bit 2	Byte 21: Bit 2	SET_DQA: Controls the value of the digital output DQn.A, if TM_CTRL_DQ = 0 • 0 = 0V on DQn.A • 1 = 24V on DQn.A
Byte 9: Bit 3	Byte 21: Bit 3	SET_DQB: Controls the value of the digital output DQn.B, if TM_CTRL_DQ = 0 • 0 = 0V on DQn.B • 1 = 24V on DQn.B
Byte 10: Bit 0	Byte 22: Bit 0	RES_ERROR: Reset pending errors (ERR_LD, ERR_DQA, ERR_DQB, and ERR_24V). • 0 = Reset of errors is not active. • 1 = Reset of errors is active.

[1] Only if the module is configured as "2 channels (2 A)" and not "1 channel (4 A)"

Feedback Interface: 2 channels, 16 input bytes (I addresses)

CPU output address		Description
Channel 0	**Channel 1[1]**	
Byte 0: Bit 0	Byte 8: Bit 0	ERR_PWR: 1 = 24 V DC present, but is not in the correct range. 0 = no error
Byte 0: Bit 1	Byte 8: Bit 1	ERR_24V: 1 = Short-circuit/overload, in the 24 V DC sensor supply output. 0 = no error
Byte 0: Bit 2	Byte 8: Bit 2	ERR_LD: 1 = Error while loading a parameter value using single-update mode. 0 = no error
Byte 0: Bit 3	Byte 8: Bit 3	ERR_PULSE: 1 = Pulse duration reduced to smaller than the minimum allowed during operation. 0 = No error
Byte 0: Bit 4	Byte 8: Bit 4	ERR_DQA: 1 = Short-circuit/overload on the digital output DQn.A. 0 = no error
Byte 0: Bit 5	Byte 8: Bit 5	ERR_DQB: 1 = Short-circuit/overload on the digital output DQn.B or attempt to set both DQn.A and DQn.B to high. 0 = no error
Byte 0: Bit 6	Byte 8: Bit 6	ERR_OUT_VAL: 1 = The value in OUTPUT_VALUE is not valid. 0 = no error
Byte 0: Bit 7	Byte 8: Bit 7	ERR_SLOT_VAL: 1 = The value in SLOT is not valid where MODE_SLOT = 1 (permanent update). 0 = no error
Byte 1: Bit 2	Byte 9: Bit 2	STS_LD_SLOT: Toggle acknowledge bit for each action of the SLOT in single-update SLOT-mode Each toggle of this bit means a successful LD_SLOT action.
Byte 1: Bit 4	Byte 9: Bit 4	STS_READY: 1 = Module is parameterized correctly, running, and delivering valid data. 0 = not ready
Byte 1: Bit 5	Byte 9: Bit 5	ST_SW_ENABLE: 1 = SW_ENABLE active. 0 = SW_ENABLE not active
Byte 2: Bit 0	Byte 10: Bit 0	STS_ENABLE: 1 = Output sequence running. 0 = No output sequence running
Byte 2: Bit 1	Byte 10: Bit 1	STS_DQA: 1 = DQn.A output active. 0 = DQn.A output not active.
Byte 2: Bit 2	Byte 10: Bit 2	STS_DQB: 1 = DQn.B output active. 0 = DQn.B output not active.
Byte 2: Bit 3	Byte 10: Bit 3	STS_DI: 1 = DIn.0 digital input active. 0 = DIn.0 digital input not active.
Byte 3: Bit 0 to 3	Byte 11: Bit 0 to 3	SEQ_CNT: Sequence counter: Is incremented after completion of an output sequence (Range 0 to 15)
Word 4	Word 12	MEASURED_CURRENT: Current measurement uses a SIMATIC S7 analog value. Full-scale value depends on module configuration, as 2 channel (2 A) or 1 channel (4 A). • 2 channel (2 A): 0 to 32767 corresponds with 0 to 2.4 A • 1 channel (4 A): 0 to 32767 corresponds with 0 to 4.8 A
Byte 6: Bit 0	Byte 14: Bit 0	QLMN_LLM: The low limit of the manipulated value has been reached.
Byte 6: Bit 1	Byte 14: Bit 1	QLMN_HLM: The high limit of the manipulated value has been reached.

[1] Only if the module is configured as "2 channels (2 A)" and not "1 channel (4 A)"

Note

If the TM FCT070 external supply voltage is interrupted, then, 16#00000000 is returned as feedback value (substitute value).

Controlling the different operating modes

You select an output channel's operating mode during device configuration. Configuration data is stored in parameter data record 128.
The following table shows the program variables that the different operating modes use.

Program control variable	Notes
Software enable	
SW_ENABLE	Transition from 0 → 1 and remaining 1 during the input delay starts the output sequence. Only active for the first positive edge, additional positive edges are ignored and no start occurs. You must always issue the software enable in your control program. If you don't use a HW enable, the output sequence will be started by the positive edge of the software enable. If you reset the software enable, the current output sequence will be terminated.
Direct control of the digital output	
TM_CTRL_DQ	• If TM_CTRL_DQ = 1, then the TM FCT070 module has control and produces pulse sequences at the DQ outputs. • If TM_CTRL_DQ = 0, then the CPU has control and your program can set outputs DQn.A and DQn.B directly with the SET_DQA and SET_DQB control bits
SET_DQA SET_DQB	These control bits set/reset a channel's DQn.A and DQn.B outputs while TM_CTRL_DQ = 0. Note: You cannot set a channel's DQn.A and DQn.B to high at the same time. Otherwise, error ERR_DQB is set and only DQn.A is set high.
Pulse output operating mode	
Pulse duration	Assign the pulse duration directly with the control interface parameter OUTPUT_VALUE, as a DWord number value in µs.
On-delay	The time from the start of the output sequence to the start of the DQ output pulse. Assign the On-delay in µs with control interface parameter SLOT, after setting up MODE_SLOT (0 or 1) and LD_SLOT = 2.
PWM operating mode	
Duty cycle or Target current (current control enabled)	**Current control disabled**: PWM: OUTPUT_VALUE assigns the duty cycle (On/Off ratio) for the current period duration. You select the range of the OUTPUT_VALUE control interface field with the "Output format" configuration. • Output format "Per 100 (%)": Value range between 0 and 100 Pulse duration = (OUTPUT_VALUE/100) x period duration. • Output format "Per 1,000": Value range between 0 and 1,000 Pulse duration = (OUTPUT_VALUE/1,000) x period duration. • Output format "Per 10,000": Value range between 0 and 10,000 Pulse duration = (OUTPUT_VALUE/10,000) x period duration. • "S7 analog output" output format: Value range between 0 and 27,648 Pulse duration = (OUTPUT_VALUE/27,648) x period duration. **Current control enabled:** OUTPUT_VALUE assigns the target current as a ratio of target current/reference current. The reference current value is used to define the maximum set point and the high and low limits of the controlled current. Typically, the maximum current can be measured in PWM mode with current control disabled and a duty cycle set to 100%. The value measured can be set as a reference for the current control. The maximum value is 4000 mA for single channel operation (parallel channel connection enabled) and 2000 mA per channel for dual channel operation (parallel connection disabled).
Period duration	The Period duration of an output PWM cycle. Assign the period duration value in µs with control interface parameter SLOT, after setting up MODE_SLOT (0 or 1) and LD_SLOT = 1. When you assign the period duration, take into account the minimum pulse duration configuration and the response time of the control element connected to the DQ digital output.
On-delay	The time from the start of the output sequence to the start of the DQ output pulse. Assign the On-delay in µs with control interface parameter SLOT, after setting up MODE_SLOT (0 or 1) and LD_SLOT = 2.
Pulse train operating mode	

Program control variable	Notes
Number of pulses	Number of pulses that are output at the DQ digital output on expiration of the On-delay. Your control program can set the pulse count directly with the control interface parameter (OUTPUT_VALUE). Set the number of pulses directly as a DWord number value between 0 to 4,294,967,295 (2^{32}-1).
Period duration	The Period duration of an output pulse cycle. Assign the period duration in µs with control interface parameter SLOT, after setting up MODE_SLOT (0 or 1) and LD_SLOT = 1. When you assign the period duration take into account the minimum pulse duration configuration and the response time of the control element connected to the DQ digital output.
Duty cycle	Assign the duty cycle with control interface parameter SLOT, after setting up MODE_SLOT (0 or 1) and LD_SLOT = 4. The range of the duty cycle parameter is selected using the "Output format" configuration. If the number value you assign exceeds the upper limit, then a duty cycle of 100% of the period duration is used and this action does not cause an error. • Output format "Per 100 (%)": Value range 0 to 100 Pulse duration = (duty cycle/100) x period duration. • Output format "Per 1000": Value range 0 to 1,000 Pulse duration = (duty cycle/1,000) x period duration. • Output format "Per 10000": Value range 0 to 10,000 Pulse duration = (duty cycle/10,000) x period duration. • Output format "S7 analog output": Value range 0 to 27,648 Pulse duration = (duty cycle/27,648) x period duration.
On/Off-delay operating mode	
On-delay	The time between a positive edge of the DIn.0 digital input and DQn.A digital output (DQ follows DI state). Assign the On-delay in µs directly using the OUTPUT_VALUE control interface field.
Off-delay	The time between a negative edge of the DIn.0 digital input and its output on the DQn.A digital output (DQ follows DI state). Assign the Off-delay in µs with control interface parameter SLOT, after setting up MODE_SLOT (0 or 1) and LD_SLOT = 3.
Frequency output operating mode	
Output frequency	Frequency output at the digital output DQ. Assign the frequency in real format as Hz using the OUTPUT_VALUE control interface field. The possible range is dependent on the "High Speed Output" configuration. • High Speed Output disabled Frequency (OUTPUT_VALUE): 0.02 Hz to 10,000 Hz • High Speed Output enabled Frequency (OUTPUT_VALUE): 0.02Hz to 100,000Hz
On-delay	The time from the start of the output sequence to the output of the frequency. Assign the On-delay in µs with control interface parameter SLOT, after setting up MODE_SLOT (0 or 1) and LD_SLOT = 2.
DC motor operating mode	
OUTPUT_VALUE	The OUTPUT_VALUE determines the duty cycle (pulse duration/period duration ratio) within a period (PWM). The period duration can be adjusted. The new output value is applied at the next rising edge of the output. The sign indicates direction of rotation (positive for forward) and (negative for backward). S7 analog output format: value range is -27,648 to +27,648 DInt data type: Only 2 least significant bytes are used For channel 0: bytes 2 and 3 For channel 1: bytes 14 and 15
On-delay	The time from the start of the output sequence to the output of the frequency. Assign the On-delay in µs with control interface parameter SLOT, after setting up MODE_SLOT (0 or 1) and LD_SLOT = 2.
If "Function DI" is parameterized as "External stop":	A rising edge on DIn.0 will stop the output sequence and stop the DC motor.

Device configuration (Assignments stored in parameter data record 128)

Parameters	Value Range			Default
Channel configuration	• 2 channels (2 A) • 1 channel (4 A)			2 channels (2 A)
Channel (0 and 1)				
Reaction to CPU STOP	• Continue working mode • DQ substitute a value			DQ substitute a value
Substitute value DQA	0 or 1			0
Substitute value DQB	0 or 1			0
Group diagnostics	Disable/enable			Disabled
Diagnostics DQA				Disabled
Diagnostics DQB				Disabled
Operating mode	• Pulse output • PWM • Pulse train • On/Off-delay • Frequency output • DC motor			PWM
High-speed output (0.1 A)	Disable/enable			Disabled
Current control (for PWM mode only)	Disable/enable			Disabled
Function DI HW enable option available for Pulse output, Pulse train, Frequency output and DC motor modes.	• Input • HW enable • External stop (DC motor only)			Input
Activate P	P-SEL: Add Proportional term for current control			Enabled
Activate I	I-SEL: Add Integral term for current control			Enabled
Activate D	D-SEL: Add Derivative term for current control			Disabled
Input delay	• Off (4µs) • 0.05 ms • 0.1 ms • 0.4 ms • 0.8 ms • 1.6 ms • 3.2 ms • 12.8 ms • 20 ms			0.1 ms
Output format: PWM and Pulse train modes DC motor mode, (only S7 analog output format is possible)	• S7 analog output format • Per 100 • Per 1000 • Per 10000			Per 100
Output format (in the "Frequency output" operating mode)	1 Hz			1 Hz
Dithering (PWM mode only): Superimpose dithering waveform on PWM output sequence.	Disable/enable			Disabled
	Minimum		Maximum	
	High-speed **disabled**	High-speed **enabled**		

Parameters	Value Range			Default
DWord: Minimum pulse duration for PWM and DC motor modes	10 µs	1.5 µs	85,000,000 µs	0
DWord: Period duration for PWM, Pulse train, and DC motor modes	100 µs	10 µs		2,000,000 µs
DWord: On-delay for all modes except On/Off-delay	0 µs	0 µs		0
DWord: Value depends on mode				
PWM: Dither ramp	Low word: Dither ramp-up time 0 to 30000 ms High word: Dither ramp-down 0 to 30000 ms			0 ms 0 ms
Pulse train: Duty cycle	S7 analog output format: 0 to 27648			13824 (50%)
	Per 100 format: 0 to100			50 (50%)
	Per 1000 format: 0 to 1000			500 (50%)
	Per 10000 format: 0 to 10000			5000 (50%)
On/Off delay: Off delay	0 to 85,000,000 µs			0
DWord: Dither amplitude for PWM only	0 to 500 ‰ (per mill)			50 ‰
DWord: Dither period for PWM only	From (4 times the PWM period µs) to 100000 µs (must be higher than 2000 µs)			50000 µs
Word: Reference value current for PWM with current control only	• 0 mA to 2000 mA for "2 channels (2 A)" operation • 0 mA to 4000 mA for "1 channel (4 A)" operation to 4000 mA for "1 channel (4 A)" operation			0 mA
Word: Dead band width (µA) for current control	0 µA to 65535 µA			0 µA
Word: High current limit for current control	S7-analog value relative to the reference value current: Range is 1 to 65535 (>= 27648 means 100%)			27648
Word: Low current limit for current control	S7-analog value relative to the reference value current: Range 0 to 27647 (Low limit must be less than the High limit)			0
Gain for current control	Real value (DWord size)			2.0 s
TI: Integration time (s) for current control	Real value (DWord size)			20.0 s
TD: Derivative action time (s) for current control	Real value (DWord size)			10 .0 s
TM LAG: Time lag of the derivative action (s)	Real value (DWord size)			2.0 s

IO data

A

Input data

Bit → / Byte ↓	7	6	5	4	3	2	1	0	data type
0	**Mass flow** low flow cut-off filtered mass flow in mass flow units, see Parameter assignment and structure of the parameter data record (Page 65)								Float32
1									
2									
3									
4	**Quality code mass flow** coding according PROFIBUS-PA profile 4.0								Unsigned8
5	**Density** in density units, see Parameter assignment and structure of the parameter data record (Page 65)								Float32
6									
7									
8									
9	**Quality code density** coding according PROFIBUS-PA profile 4.0								Unsigned8
10	**Medium temperature** in temperature units, see Parameter assignment and structure of the parameter data record (Page 65)								Float32
11									
12									
13									
14	**Quality code medium temperature** coding according PROFIBUS-PA profile 4.0								Unsigned8
15	**Volume flow** low flow cut-off filtered volume flow in volume flow units, see Parameter assignment and structure of the parameter data record (Page 65)								Float32
16									
17									
18									
19	**Quality code volume flow** coding according PROFIBUS-PA profile 4.0								Unsigned8
20	**Fraction A** unit relation depends on the selected fraction table. Each fraction table calculates either a mass flow or a volume flow quantity. The Fraction unit type bit in byte 81 defines if the mass flow or volume flow unit setting is relevant.								Float32
21									
22									
23									
24	**Quality code fraction A** coding according PROFIBUS-PA profile 4.0								Unsigned8
25	**Fraction B** unit relation depends on the selected fraction table. Each fraction table calculates either a mass flow or a volume flow quantity. The Fraction unit type bit in byte 81 defines if the mass flow or volume flow unit setting is relevant.								Float32
26									
27									
28									
29	**Quality code fraction B** coding according PROFIBUS-PA profile 4.0								Unsigned8

Bit → / Byte ↓	7	6	5	4	3	2	1	0	data type
30	**Fraction A %** in percent								Float32
31									
32									
33									
34	**Quality code fraction A %** coding according PROFIBUS-PA profile 4.0								Unsigned8
35	**Fraction B %** in percent								Float32
36									
37									
38									
39	Quality code fraction B % coding according PROFIBUS-PA profile 4.0								Unsigned8
40	**Standard volume flow** in standard volume flow units, see Parameter assignment and structure of the parameter data record (Page 65)								Float32
41									
42									
43									
44	**Quality code standard volume flow** coding according PROFIBUS-PA profile 4.0								Unsigned8
45	**Sensor frame temperature** in temperature units, see Parameter assignment and structure of the parameter data record (Page 65)								Float32
46									
47									
48									
49	**Quality code sensor frame temperature** coding according PROFIBUS-PA profile 4.0								Unsigned8
50	**Total 1** Unit is depending on the selected Totalizer 1 process value and Totalizer 1 mass/volume/standard volume setting, see Parameter assignment and structure of the parameter data record (Page 65)								Float32
51									
52									
53									
54	**Quality code total 1** coding according PROFIBUS-PA profile 4.0								Unsigned8
55	**Total 1 (high resolution)** Unit is depending on the selected Totalizer 1 process value and Totalizer 1 mass/volume/standard volume setting, see Parameter assignment and structure of the parameter data record (Page 65)								Float64
56									
57									
58									
59									
60									
61									
62									
63	**Total 2** Unit is depending on the selected Totalizer 2 process value and Totalizer 2 mass/volume/standard volume setting, see Parameter assignment and structure of the parameter data record (Page 65)								Float32
64									
65									
66									
67	**Quality code total 2** coding according PROFIBUS-PA profile 4.0								Unsigned8

Bit → / Byte ↓	7	6	5	4	3	2	1	0	data type
68	**Total 3** Unit is depending on the selected Totalizer 3 process value and Totalizer 3 mass/volume/standard volume setting, see Parameter assignment and structure of the parameter data record (Page 65)								Float32
69									
70									
71									
72	**Quality code total 3** coding according PROFIBUS-PA profile 4.0								Unsigned8
73	**Dosed amount** Unit is depending on the selected Dosing process value and Dosing amount mass/volume/standard volume setting, see Parameter assignment and structure of the parameter data record (Page 65)								Float32
74									
75									
76									
77	**Quality code dosed amount** coding according PROFIBUS-PA profile 4.0								Unsigned8
78	**Dosing state** 0 = stopped 1 = running 2 = paused 3 = cleaning, all valves are set to "open valve"								Unsigned8
79	*reserved*	*reserved*	*reserved*	*reserved*	*reserved*	*reserved*	**DQ1** current signal state	**DQ0** current signal state	Unsigned8 (bit granular)
80	*reserved*	*reserved*	*reserved*	*reserved*	*reserved*	*reserved*	**DQ1 status** Validity of the DQ1 value in previous byte 0 = DQ1 is disabled (not controlled) 1 = DQ1 is enabled (controlled)	**DQ0 status** Validity of the DQ0 value in previous byte 0 = DQ0 is disabled (not controlled) 1 = DQ0 is enabled (controlled)	Unsigned8 (bit granular)
81	*reserved*	*reserved*	*reserved*	*reserved*	*reserved*	*reserved*	**DI1** current signal state	**DI0** current signal state	Unsigned8 (bit granular)
82	**Fraction unit type** returns information which unit is associated to the fraction values 0 = Mass flow units 1 = Volume flow units	*reserved*	*reserved*	*reserved*	*reserved*	outputs forced	process value frozen	zero point adjustment running	Unsigned8 (bit granular)

Ouput data

Bit → / Byte ↓	7	6	5	4	3	2	1	0	data type
0	*reserved*	*reserved*	Reset totalizer 3	Reset totalizer 2	Reset totalizer 1	Force outputs	Freeze process values	Adjust zero point	Unsigned8 (bit granular)
1	**Dosing command** The value change triggers the command. 0 = do nothing 1 = start dosing 2 = stop dosing 3 = pause dosing 4 = resume dosing 5 = start cleaning								Unsigned8
2	**Dosing amount** The value is expected in the unit that is defined by the selected Dosing process value and Dosing amount mass/volume/standard volume setting, see Parameter assignment and structure of the parameter data record (Page 65)								Float32
3									
4									
5									
6	**Active fraction table** Selects the built-in fraction table algorithm. Valid range is 0 (no fraction), 1...17								Unsigned8

Parameter data record

B

B.1 Parameter assignment and structure of the parameter data record

The TM FCT070 parameter data record is modified and stored for you by the TIA portal when you perform a Device configuration, successful configuration block compilation, and download a new configuration block to the system hardware.

You may also directly edit the module parameters with the CPU in RUN mode. The WRREC instruction is used to transfer parameters to the module using data record 128.

If errors occur during the transfer or validation of parameters with the WRREC instruction, the module continues operation with the previous parameter assignment. A corresponding error code is then written to the STATUS output parameter. If no errors occur, the STATUS output parameter contains the length of the data actually transferred.

The description of the WRREC instruction and the error codes is available in the STEP 7 online help (TIA Portal).

Structure of data record 128

The following table shows you the structure of data record 128 for the TM FCT070. The values in byte 0 to byte 3 are fixed and may not be changed. Default values are indicated in **bold font**.

- A total of 108 bytes (4 header bytes + 2(52 channel bytes) is required for the 2 channel configuration (parallel connection disabled).
- A total of 56 byes (4 header bytes + 52 channel bytes) is required for the 1 channel configuration (parallel connection enabled).
- Bytes 4 to 55 are the channel 0 parameters
- Bytes 56 to 107 are the channel 1 parameters.
- Channel 1 parameters use the same data structure as channel 0. Add a 52 byte offset to the channel 0 byte numbers, to determine the channel 1 byte numbers.

Table B-1 Header and channel 0 basic configuration

Bit → **Byte ↓**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0 to 1	**Header**							
0	*reserved*		Major version = 1		Minor version = 0			
1	Parameter data length = 58 bytes							
2 to 55	**Module parameter block**							
2	Mass flow units coding according PROFIBUS-PA profile. Supported values: 1322 1323 **1324** 1325..1341 1606..1609							
3								

Bit → / Byte ↓	7	6	5	4	3	2	1	0
4	Density units coding according PROFIBUS-PA profile. Supported values: 1097..1102 **1103** 1104..1109 1430 1558 1559 1564 1566							
5								
6	Temperature units coding according PROFIBUS-PA profile. Supported values: 1000 **1001** 1002 1003							
7								
8	Volume flow units coding according PROFIBUS-PA profile. Supported values: 1347 1348 **1349** 1350..1359 1362..1374 1448..1514 1518..1520 1563 1577..1587 1633..1640 1642..1645 32768..32780							
9								
10	Standard volume flow units coding according PROFIBUS-PA profile. Supported values: 1360 1361 1588..1595 **1596** 1597..1605							
11								
12	Mass flow cut-off limit (mass flow units) encoded as Float32 Default value = **0.0**							
13								
14								
15								
16	Volume flow cut-off limit (volume flow units) encoded as Float32 Default value = **0.0**							
17								
18								
19								
20	*reserved*	*reserved*	*reserved*	*reserved*	Totalizer 1 process value Selection of the process value to be totalized: **0 = Mass flow** 1 = Volume flow 4 = Standard volume flow 5 = Fraction A 6 = Fraction B			
21	Totalizer 1 mass units Only relevant if the selected process value is a mass quantity. Supported values (coding according PROFIBUS-PA profile): **1088** 1089..1096 1567..1569							
22								
23	Totalizer 1 volume units Only relevant if the selected process value is a volume quantity. Supported values (coding according PROFIBUS-PA profile): **1034** 1035..1052 1517 1570 1572 1641							
24								
25	Totalizer 1 standard volume units Only relevant if the selected process value is a standard volume quantity. Supported values (coding according PROFIBUS-PA profile): 1053 1573 1574 **1575** 1576							
26								

Bit → / Byte ↓	7	6	5	4	3	2	1	0
27	*reserved*	*reserved*	*reserved*	*reserved*	Totalizer 2 process value Selection of the process value to be totalized: 0 = Mass flow **1 = Volume flow** 4 = Standard volume flow 5 = Fraction A 6 = Fraction B			
28 **29**	Totalizer 2 mass units Only relevant if the selected process value is a mass quantity. Supported values (coding according PROFIBUS-PA profile): **1088** 1089..1096 1567..1569							
30 **31**	Totalizer 2 volume units Only relevant if the selected process value is a volume quantity. Supported values (coding according PROFIBUS-PA profile): **1034** 1035..1052 1517 1570 1572 1641							
32 **33**	Totalizer 2 standard volume units Only relevant if the selected process value is a standard volume quantity. Supported values (coding according PROFIBUS-PA profile): 1053 1573 1574 **1575** 1576							
34	*reserved*	*reserved*	*reserved*	*reserved*	Totalizer 3 process value Selection of the process value to be totalized: 0 = Mass flow 1 = Volume flow **4 = Standard volume flow** 5 = Fraction A 6 = Fraction B			
35 **36**	Totalizer 3 mass units Only relevant if the selected process value is a mass quantity. Supported values (coding according PROFIBUS-PA profile): **1088** 1089..1096 1567..1569							
37 **38**	Totalizer 3 volume units Only relevant if the selected process value is a volume quantity. Supported values (coding according PROFIBUS-PA profile): **1034** 1035..1052 1517 1570 1572 1641							
39 **40**	Totalizer 3 standard volume units Only relevant if the selected process value is a standard volume quantity. Supported values (coding according PROFIBUS-PA profile): 1053 1573 1574 **1575** 1576							

Bit → / Byte ↓	7	6	5	4	3	2	1	0
41	DI0 level selection 0 = "Active with low level" **1 = "Active with high level"**	*reserved*	*reserved*	DI0 mode **0 = off** 1 = Start dosing on leading edge 2 = Stop dosing on leading edge 3 = Reset totalizer 1 on leading edge 4 = Reset totalizer 2 on leading edge 5 = Reset totalizer 3 on leading edge 6 = Reset all totalizers on leading edge 7 = Zero adjust on leading edge 8 = Pause/resume dosing 9 = Force outputs 10 = Freeze process values 11 = Start/stop totalizer 1 12 = Start/stop totalizer 2 13 = Start/stop totalizer 3 14..31 = reserved				
42	DI1 level selection 0 = "Active with low level" **1 = "Active with high level"**	*reserved*	*reserved*	DI1 mode see "DI0 mode"				
43	DQ0 level selection 0 = "Active with low level" **1 = "Active with high level"**	DQ0 status signal "function check" **0 = "Deactivated"** 1 = "Activated"	DQ0 status signal "maintenance required" **0 = "Deactivated"** 1 = "Activated"	DQ0 status signal "failure" 0 = "Deactivated" **1 = "Activated"**	DQ0 status signal "out of specification" **0 = "Deactivated"** 1 = "Activated"	DQ0 force value 0 = "Deactivated" **1 = "Activated"**	DQ0 mode **0 = off** 1 = status signal 2 = flow direction (positive=active, negative=inactive) 3 = reserved Only valid if "Dosing mode" is not set to 1 and 2	
44	DQ1 level selection 0 = "Active with low level" **1 = "Active with high level"**	DQ1 status signal "function check" **0 = "Deactivated"** 1 = "Activated"	DQ1 status signal "maintenance required" **0 = "Deactivated"** 1 = "Activated"	DQ1 status signal "failure" 0 = "Deactivated" **1 = "Activated"**	DQ1 status signal "out of specification" **0 = "Deactivated"** 1 = "Activated"	DQ1 force value 0 = "Deactivated" **1 = "Activated"**	DQ1 mode **0 = off** 1 = status signal 2 = flow direction (positive=active, negative=inactive) 3 = reserved Only valid if "Dosing mode" is not set to 2	

Bit → / Byte ↓	7	6	5	4	3	2	1	0
45	*reserved*	*reserved*	Dosing mode **0 = off** 1 = Dosing with one valve controlled by DQ0. Overrides the DQ0 mode setting 2 = Dosing with two valves (DQ0/DQ1). Overrides the DQ0 and DQ1 mode settings 3 = reserved		Dosing process value Selection of the process value to be dosed: **0 = Mass flow** 1 = Volume flow 4 = Standard volume flow 5 = Fraction A 6 = Fraction B			
46	Dosing amount mass unit							
47	Only relevant if the selected process value is a mass quantity.							
	Supported values (coding according PROFIBUS-PA profile):							
	1088 1089..1096 1567..1569							
48	Dosing amount volume unit							
49	Only relevant if the selected process value is a volume quantity.							
	Supported values (coding according PROFIBUS-PA profile):							
	1034 1035..1052 1517 1570 1572 1641							
50	Dosing amount standard volume unit							
51	Only relevant if the selected process value is a standard volume quantity.							
	Supported values (coding according PROFIBUS-PA profile):							
	1053 1573..1576							
52	Dosing amount DQ1 open in percent. Only relevant when dosing mode is set to 2 Valid range = 0...100% **Default = 20%**							
53								
54								
55								
56	Dosing amount DQ1 close in percent. Only relevant when dosing mode is set to 2 Valid range = 0...100% **Default = 80%**							
57								
58								
59								

Measuring units

C

	Unit descriptions	Unit abbreviations	Volume flow	Mass flow	Standard Volume flow	Density	Temperature
1000	kelvins	K					x
1001	degrees Celsius	°C					x
1002	degrees Fahrenheit	°F					x
1003	degrees Rankine	°R					x
1034	cubic meters	m^3					
1035	cubic decimeters	dm^3					
1036	cubic centimeters	cm^3					
1037	cubic millimeters	mm^3					
1038	liters	l					
1039	centiliters	cl					
1040	milliliters	ml					
1041	hectoliters	hl					
1042	cubic inches	in^3					
1043	cubic feet	ft^3					
1044	cubic yards	yd^3					
1045	cubic miles	mi^3					
1046	US liquid pints	pt(liq)					
1047	US liquid quarts	qt(liq)					
1048	US gallons	gal					
1049	imperial gallons	gal(UK)					
1050	bushels	bu					
1051	42 US gallons barrels	bbl					
1052	31.5 US gallons barrels	bbl(US)					
1053	standard cubic feet	SCF					
1088	kilograms	kg					
1089	grams	g					
1090	megagrams	Mg					
1091	megagrams	Mg					
1092	metric tons	t					
1093	ounces avoirdupois	oz					
1094	pounds	lb					
1095	short tons	ton					
1096	long tons	ton(UK)					
1097	kilograms per cubic meter	kg/m^3				x	

	Unit descriptions	Unit abbreviations	Volume flow	Mass flow	Standard Volume flow	Density	Temperature
1098	megagrams per cubic meter	Mg/m^3				x	
1099	kilograms per cubic decimeter	kg/dm^3				x	
1100	grams per cubic centimeter	g/cm^3				x	
1101	grams per cubic meter	g/m^3				x	
1102	metric tons per cubic meter	t/m^3				x	
1103	kilograms per liter	kg/l				x	
1104	grams per milliliter	g/ml				x	
1105	grams per liter	g/l				x	
1106	pounds per cubic inch	lb/in^3				x	
1107	pounds per cubic foot	lb/ft^3				x	
1108	pounds per US gallon	lb/gal				x	
1109	short tons per cubic yard	ton/yd^3				x	
1322	kilograms per second	kg/s			x		
1323	kilograms per minute	kg/min			x		
1324	kilograms per hour	kg/h			x		
1325	kilograms per day	kg/d			x		
1326	metric tons per second	t/s			x		
1327	metric tons per minute	t/min			x		
1328	metric tons per hour	t/h			x		
1329	metric tons per day	t/d			x		
1330	pounds per second	lb/s			x		
1331	pounds per minute	lb/min			x		
1332	pounds per hour	lb/h			x		
1333	pounds per day	lb/d			x		
1334	short tons per second	ton/s			x		
1335	short tons per minute	ton/min			x		
1336	short tons per hour	ton/h			x		
1337	short tons per day	ton/d			x		
1338	long tons per second	ton(UK)/s			x		
1339	long tons per minute	ton(UK)/min		x			
1340	long tons per hour	ton(UK)/h			x		
1341	long tons per day	ton(UK)/d			x		
1347	cubic meters per second	m^3/s	x				
1348	cubic meters per minute	m^3/min	x				
1349	cubic meters per hour	m^3/h	x				

	Unit descriptions	Unit abbreviations	Volume flow	Mass flow	Standard Volume flow	Density	Temperature
1350	cubic meters per day	m^3/d	x				
1351	liters per second	l/s	x				
1352	liters per minute	l/min	x				
1353	liters per hour	l/h	x				
1354	liters per day	l/d	x				
1355	milliliters per day	ml/d	x				
1356	cubic feet per second	ft^3/s	x				
1357	cubic feet per minute	ft^3/min	x				
1358	cubic feet per hour	ft^3/h	x				
1359	cubic feet per day	ft^3/d	x				
1360	standard cubic feet per minute	SCF/min	x		x		
1361	standard cubic feet per hour	SCF/h	x		x		
1362	US gallons per second	gal/s	x				
1363	US gallons per minute	gal/min	x				
1364	US gallons per hour	gal/h	x				
1365	US gallons per day	gal/d	x				
1366	US milligallons per day	mgal/d	x				
1367	imperial gallons per second	gal(UK)/s	x				
1368	imperial gallons per minute	gal(UK)/min	x				
1369	imperial gallons per hour	gal(UK)/h	x				
1370	imperial gallons per day	gal(UK)/d	x				
1371	42 US gallons barrels per second	bbl/s	x				
1372	42 US gallons barrels per minute	bbl/min	x				
1373	42 US gallons barrels per hour	bbl/h	x				
1374	42 US gallons barrels per day	bbl/d	x				
1430	pounds per imperial gallon	lb/gal(UK)	x			x	
1448	US microgallons per second	µgal/s	x				
1449	US milligallons per second	mgal/s	x				
1450	US kilogallons per second	kgal/s	x				
1451	US milligallons per second	mgal/s	x				

	Unit descriptions	Unit abbreviations	Volume flow	Mass flow	Standard Volume flow	Density	Temperature
1452	US microgallons per minute	µgal/min	x				
1453	US milligallons per minute	mgal/min	x				
1454	US kilogallons per minute	kgal/min	x				
1455	US milligallons per minute	mgal/min	x				
1456	US microgallons per hour	µgal/h	x				
1457	US milligallons per hour	mgal/h	x				
1458	US kilogallons per hour	kgal/h	x				
1459	US milligallons per hour	mgal/h	x				
1460	US microgallons per day	µgal/d	x				
1461	US milligallons per day	mgal/d	x				
1462	US kilogallons per day	kgal/d	x				
1463	imperial microgallons per second	µgal(UK)/s	x				
1464	imperial megagallons per second	Mgal(UK)/s	x				
1465	imperial kilogallons per second	kgal(UK)/s	x				
1466	imperial megagallons per second	Mgal(UK)/s	x				
1467	imperial microgallons per minute	µgal(UK)/min	x				
1468	imperial megagallons per minute	Mgal(UK)/min	x				
1469	imperial kilogallons per minute	kgal(UK)/min	x				
1470	imperial megagallons per minute	Mgal(UK)/min	x				
1471	imperial microgallons per hour	µgal(UK)/h	x				
1472	imperial megagallons per hour	Mgal(UK)/h	x				
1473	imperial kilogallons per hour	kgal(UK)/h	x				
1474	imperial megagallons per hour	Mgal(UK)/h	x				
1475	imperial microgallons per day	µgal(UK)/d	x				

	Unit descriptions	Unit abbreviations	Volume flow	Mass flow	Standard Volume flow	Density	Temperature
1476	imperial megagallons per day	Mgal(UK)/d	x				
1477	imperial kilogallons per day	kgal(UK)/d	x				
1478	imperial megagallons per day	Mgal(UK)/d	x				
1479	millionth of a 42 US gallons barrel per second	µbbl/s	x				
1480	million 42 US gallons barrels per second	Mbbl/s					
1481	thousand 42 US gallons barrels per second	kbbl/s	x				
1482	million 42 US gallons barrels per second	Mbbl/s	x				
1483	millionth of a 42 US gallons barrel per minute	µbbl/min	x				
1484	million 42 US gallons barrels per minute	Mbbl/min	x				
1485	thousand 42 US gallons barrels per minute	kbbl/min	x				
1486	million 42 US gallons barrels per minute	Mbbl/min	x				
1487	millionth of a 42 US gallons barrel per hour	µbbl/h	x				
1488	million 42 US gallons barrels per hour	Mbbl/h	x				
1489	thousand 42 US gallons barrels per hour	kbbl/h	x				
1490	million 42 US gallons barrels per hour	Mbbl/h	x				
1491	millionth of a 42 US gallons barrel per day	µbbl/d	x				
1492	million 42 US gallons barrels per day	Mbbl/d	x				
1493	thousand 42 US gallons barrels per day	kbbl/d	x				
1494	million 42 US gallons barrels per day	Mbbl/d					
1495	cubic micrometers per second	$\mu m^3/s$	x				
1496	million cubic meters per second	Mm^3/s	x				

	Unit descriptions	Unit abbreviations	Volume flow	Mass flow	Standard Volume flow	Density	Temperature
1497	cubic kilometers per second	km^3/s	x				
1498	million cubic meters per second	Mm^3/s	x				
1499	cubic micrometers per minute	$µm^3/min$	x				
1500	million cubic meters per minute	Mm^3/min	x				
1501	cubic kilometers per minute	km^3/min	x				
1502	million cubic meters per minute	Mm^3/min	x				
1503	cubic micrometers per hour	$µm^3/h$	x				
1504	million cubic meters per hour	Mm^3/h	x				
1505	cubic kilometers per hour	km^3/h	x				
1506	million cubic meters per hour	Mm^3/h					
1507	cubic micrometers per day	$µm^3/d$	x				
1508	million cubic meters per day	Mm^3/d	x				
1509	cubic kilometers per day	km^3/d	x				
1510	million cubic meters per day	Mm^3/d	x				
1511	cubic centimeters per second	cm^3/s	x				
1512	cubic centimeters per minute	cm^3/min	x				
1513	cubic centimeters per hour	cm^3/h	x				
1514	cubic centimeters per day	cm^3/d	x				
1517	kiloliters	kl	x				
1518	kiloliters per minute	kl/min	x				
1519	kiloliters per hour	kl/h	x				
1520	kiloliters per day	kl/d	x				
1558	milligrams per liter	mg/l	x			x	
1559	micrograms per liter	µg/l	x			x	
1563	milliliters per minute	ml/min				x	
1564	milligrams per cubic decimeter	mg/dm^3	x			x	

	Unit descriptions	Unit abbreviations	Volume flow	Mass flow	Standard Volume flow	Density	Temperature
1566	megagrams per cubic meter	Mg/m^3	x				
1567	carats	ct	x				
1568	troy pounds	lb t	x				
1569	ounces troy	oz t	x				
1570	US fluid ounces	fl oz	x				
1572	acre-feet	AF	x				
1573	normal cubic meters	Nm^3	x				
1574	normal liters	Nl	x				
1575	standard cubic meters	Sm^3	x				
1577	milliliters per second	ml/s	x		x		
1578	milliliters per hour	ml/h	x		x		
1579	milliliters per day	ml/d	x		x		
1580	acre-feet per second	AF/s	x		x		
1581	acre-feet per minute	AF/min	x		x		
1582	acre-feet per hour	AF/h	x		x		
1583	acre-feet per day	AF/d	x		x		
1584	US fluid ounces per second	fl oz/s	x		x		
1585	US fluid ounces per minute	fl oz/min	x		x		
1586	US fluid ounces per hour	fl oz/h	x		x		
1587	US fluid ounces per day	fl oz/d	x		x		
1588	normal cubic meters per second	Nm^3/s	x		x		
1589	normal cubic meters per minute	Nm^3/min	x		x		
1590	normal cubic meters per hour	Nm^3/h	x		x		
1591	normal cubic meters per day	Nm^3/d	x		x		
1592	normal liters per second	Nl/s	x		x		
1593	normal liters per minute	Nl/min	x		x		
1594	normal liters per hour	Nl/h	x		x		
1595	normal liters per day	Nl/d	x		x		
1596	standard cubic meters per second	Sm^3/s	x		x		
1597	standard cubic meters per minute	Sm^3/min	x		x		

	Unit descriptions	Unit abbreviations	Volume flow	Mass flow	Standard Volume flow	Density	Temperature
1598	standard cubic meters per hour	Sm^3/h	x		x		
1599	standard cubic meters per day	Sm^3/d	x		x		
1600	standard liters per second	Sl/s	x		x		
1601	standard liters per minute	Sl/min	x		x		
1602	standard liters per hour	Sl/h	x		x		
1603	standard liters per day	Sl/d	x		x		
1604	standard cubic feet per second	SCF/s	x		x		
1605	standard cubic feet per day	SCF/d	x		x		
1606	ounces avoirdupois per second	oz/s	x		x		
1607	ounces avoirdupois per minute	oz/min	x		x		
1608	ounces avoirdupois per hour	oz/h	x		x		
1609	ounces avoirdupois per day	oz/d	x		x		
1633	hectoliters per second	hl/s	x		x		
1634	hectoliters per minute	hl/min	x		x		
1635	hectoliters per hour	hl/h	x		x		
1636	hectoliters per day	hl/d	x		x		
1637	31.5 US gallons barrels per second	bbl(US)/s	x		x		
1638	31.5 US gallons barrels per minute	bbl(US)/min	x		x		
1639	31.5 US gallons barrels per hour	bbl(US)/h	x		x		
1640	31.5 US gallons barrels per day	bbl(US)/d	x		x		
1641	31 US gallons barrels	bbl-beer	x		x		
1642	31 US gallons barrels per second	bbl-beer/s	x		x		
1643	31 US gallons barrels per minute	bbl-beer/min	x		x		
1644	31 US gallons barrels per hour	bbl-beer/h	x		x		
1645	31 US gallons barrels per day	bbl-beer/d	x		x		
32768	bushels per second	bu/s	x		x		

	Unit descriptions	Unit abbreviations	Volume flow	Mass flow	Standard Volume flow	Density	Temperature
32769	bushels per minute	bu/min	x		x		
32770	bushels per hour	bu/h	x		x		
32771	bushels per day	bu/d	x		x		
32772	cubic yards per second	yd^3/s	x		x		
32773	cubic yards per minute	yd^3/min	x		x		
32774	cubic yards per hour	yd^3/h	x		x		
32775	cubic yards per day	yd^3/d	x		x		
32776	cubic inches per second	in^3/s	x		x		
32777	cubic inches per minute	in^3/min	x		x		
32778	cubic inches per hour	in^3/h	x		x		
32779	cubic inches per day	in^3/d	x		x		
32780	million cubic feet per day	Mft^3/d	x		x		

Product documentation and support

D

D.1 Product documentation

Process instrumentation product documentation is available in the following formats:

- Certificates (http://www.siemens.com/processinstrumentation/certificates)
- Downloads (firmware, EDDs, software) (http://www.siemens.com/processinstrumentation/downloads)
- Catalog and catalog sheets (http://www.siemens.com/processinstrumentation/catalogs)
- Manuals (http://www.siemens.com/processinstrumentation/documentation)
  You have the option to show, open, save, or configure the manual.
  - "Display": Open the manual in HTML5 format
  - "Configure": Register and configure the documentation specific to your plant
  - "Download": Open or save the manual in PDF format
  - "Download as html5, only PC": Open or save the manual in the HTML5 view on your PC

You can also find manuals with the Mobile app at Industry Online Support (https://support.industry.siemens.com/cs/ww/en/sc/2067). Download the app to your mobile device and scan the device QR code.

Product documentation by serial number

Using the PIA Life Cycle Portal, you can access the serial number-specific product information including technical specifications, spare parts, calibration data, or factory certificates.

Entering a serial number

1. Open the PIA Life Cycle Portal (https://www.pia-portal.automation.siemens.com).
2. Select the desired language.
3. Enter the serial number of your device. The product documentation relevant for your device is displayed and can be downloaded.

To display factory certificates, if available, log in to the PIA Life Cycle Portal using your login or register.

Scanning a QR code

1. Scan the QR code on your device with a mobile device.
2. Click "PIA Portal".

To display factory certificates, if available, log in to the PIA Life Cycle Portal using your login or register.

D.2 Technical support

Technical support

If this documentation does not completely answer your technical questions, you can enter a Support Request (http://www.siemens.com/automation/support-request).

Additional information on our technical support can be found at Technical Support (http://www.siemens.com/automation/csi/service).

Service & support on the Internet

In addition to our technical support, Siemens offers comprehensive online services at Service & Support (http://www.siemens.com/automation/serviceandsupport).

Contact

If you have further questions about the device, contact your local Siemens representative at Personal Contact (http://www.automation.siemens.com/partner).

To find the contact for your product, go to "all products and branches" and select "Products & Services > Industrial automation > Process instrumentation".

Contact address for business unit:
Siemens AG
Digital Industries
Process Automation
Östliche Rheinbrückenstr. 50
76187 Karlsruhe, Germany

Ordering data

E

E.1 Accessories

You can order accessories online: Industry Mall (https://mallstage.industry.siemens.com/mall/en/b0/Catalog/Products/10020503?tree=CatalogTree)

The following accessories are not included in the scope of delivery:

- **Mandatory**: BaseUnit of the type B0 (order number 6ES7193-6BP20-0BB0) or B1 (order number 6ES7193-6BP20-0BB1)
  An overview of the BaseUnits that you can use with the technology module can be found in the Product Information for the documentation of the ET 200SP Distributed I/O System (http://support.automation.siemens.com/WW/view/en/73021864).
  Information regarding selection of the suitable BaseUnit can be found in the ET 200SP Distributed I/O System (http://support.automation.siemens.com/WW/view/en/58649293) system manual and in the ET 200SP BaseUnits (http://support.automation.siemens.com/WW/view/en/58532597/133300) manual.
- Labeling strips
- Color-coded labels
- Reference identification labels

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