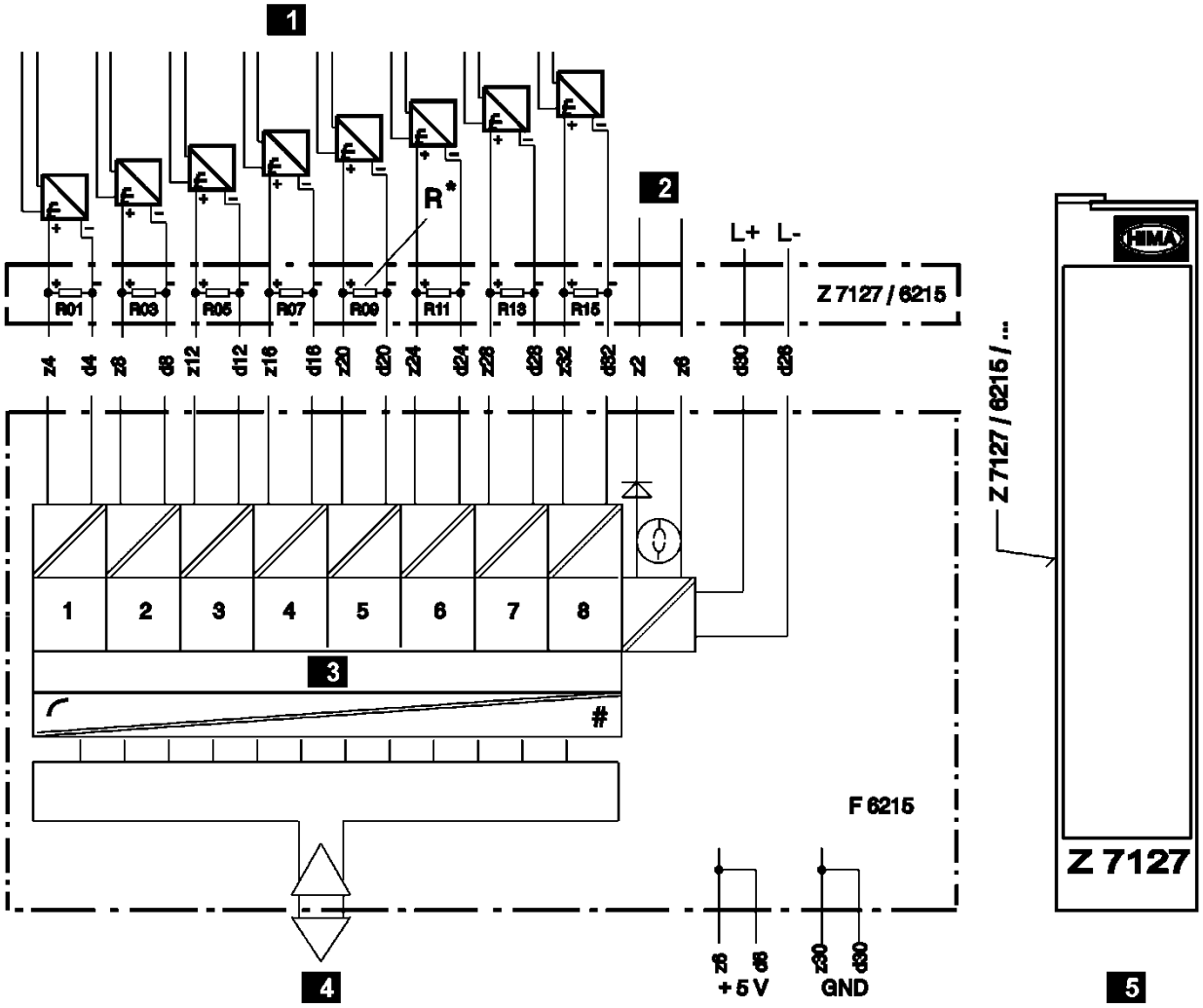
F 6215: Analog Input Module

- 8 channels for voltage inputs 0…1/5/10 V, Pt100 inputs.
- Current inputs 0/4…20 mA.
- With protective separation from the field level and galvanic separation between the inputs.
- 12-bit resolution.
- Short-circuit and open-circuit configurable in SILworX.
- For HIQuad X (SILworX) and HIQuad (ELOP II).



1 Transmitter supply
2 I_k for Pt100
3 Multiplexer
4 I/O bus
5 Cable plug, front view

Figure 1: Module's Block Diagram and Cable Plug Front View

HIMA Paul Hildebrandt GmbH, P.O. Box 1261, 68777 Brühl
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Specifications

Input voltage	0…1.06 V (approx. 6 % overflow)
Input current	0…21.3 mA (via shunt)
R*: Shunt for current measurement	50 Ω; 0.05 %; 0.125 W T < 10 ppm/K
Resolution	12-bit 0 mV = 0 1 V = 3840
Input resistance	Min. 1 MΩ
Time constant for input filter	Approx. 2.2 ms
Conversion time	Max. 4 ms for 8 channels
Intrinsic error limit	0.1 % at 25 °C
Operating error limit	0.3 % at 0…+60 °C
Withstand voltage	200 V against analog GND
I_k for Pt100	2.5 mA
Space requirement	4 HP
Current consumption	100 mA at 5 VDC (via backplane) 140 mA at 24 VDC (via cable plug)

Wiring

Refer to the corresponding tables for the wire color coding of the following cable plugs:

- Cable plug Z 7127/6215/Cx/I (U1V) for current or voltage connection (Table 1).
- Cable plug Z 7127/6215/Cx/U5V (U10V) for voltage connection via voltage divider (Table 2).

Channel	Pin	Color	Connection
1	z4	BN	Cable: LiYCY 20 x 0.25 mm² (shielded)
	d4	WH	
2	z8	YE	
	d8	GN	
3	z12	PK	
	d12	GY	
4	z16	RD	
	d16	BU	
5	z20	VT	
	d20	BK	
6	z24	WHGN	
	d24	WHBN	
7	z28	WHGY	
	d28	WHYE	
8	z32	WHBU	
	d32	WHPK	
I_k for Pt100	z2	WHRD	
	z6	WHBK	
L+ (24 VDC)	d30	RD	Female connector 2.8 x 0.8 mm² q = 1 mm², l = 750 mm
L- (24 VDC)	d26	BK	
Shield		YEGN	Female connector 6.3 x 0.8 mm² q = 2.5 mm², l = 120 mm

Table 1: Wire Color Coding of the Cable Plug Z 7127/6215/Cx/I (U1V)

Channel	Pin	Color	Connection
1	x4	BN	Cable: LiYCY 20 x 0.25 mm² (shielded)
	d4	WH	
2	x8	YE	
	d8	GN	
3	x12	PK	
	d12	GY	
4	x16	RD	
	d16	BU	
5	x20	VT	
	d20	BK	
6	x24	WHGN	
	d24	WHBN	
7	x28	WHGY	
	d28	WHYE	
8	x32	WHBU	
	d32	WHPK	
I_k for Pt100	z2	WHRD	
	z6	WHBK	
L+ (24 VDC)	d30	RD	Female connector 2.8 x 0.8 mm² q = 1 mm², l = 750 mm
L- (24 VDC)	d26	BK	
Shield		YEGN	Female connector 6.3 x 0.8 mm² q = 2.5 mm², l = 120 mm

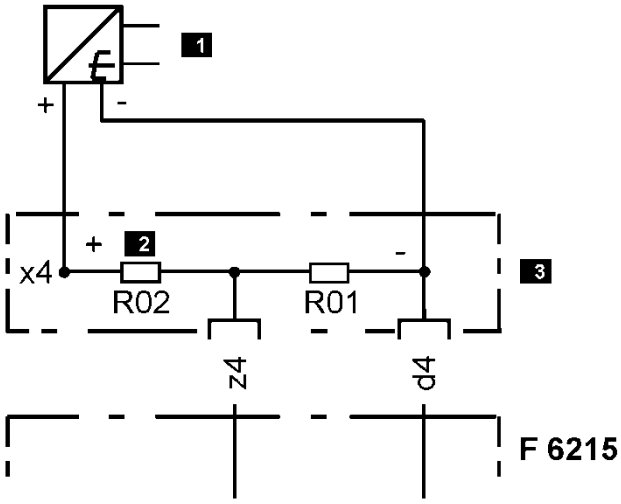
Table 2: Wire Color Coding of the Cable Plug Z 7127/6215/Cx/U5V (U10V)

i The measured values can deviate up to ±1% of the full scale value if the module is exposed to EMC interference.

HIMA recommends short-circuiting unused voltage inputs in the cable plug or on the corresponding terminal block.

Connection with Voltage Divider for Voltage Ranges up to 5 V or 10 V.

The following figure shows the connection of a voltage divider to channel 1 via cable plug Z 7127/6215/Cx/U5V (U10V). The voltage divider resistor (R02, R04…R16) depends on the selected voltage range, see Table 3.



1 Transmitter supply

2 Additional resistor R02 for voltage divider, value depending on the voltage range

3 Z 7127/6215/Cx/U5V (U10V)

Figure 2: Connection with Voltage Divider for Voltage Ranges up to 5 V or 10 V.

Measuring range U_M	R01, R03, R05, R07, R09, R11, R13, R15	R02, R04, R06, R08 R10, R12, R14, R16
0…5 V	33.2 kΩ, 1 %	133 kΩ 1 %
0…10 V	20 kΩ, 1 %	178 kΩ, 1 %

Table 3: Resistor Equipment of Voltage Divider, Channel 1…8

Due to the tolerance of the voltage divider resistors, the accuracy specified in the data sheet is only ensured after a new compensation in the user program, or resistors with tolerances < 1 % must be used.

Current Inputs 0/4…20 mA

The measuring range for the current inputs is 0/4…20 mA.

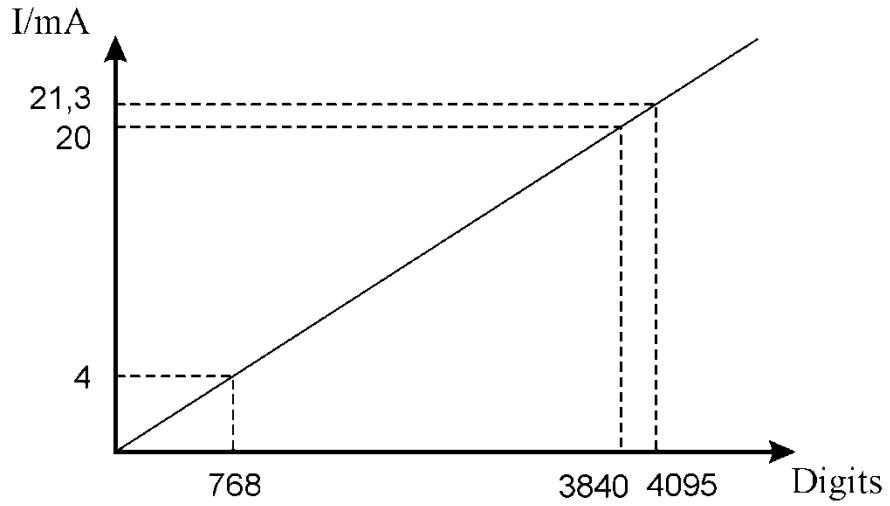
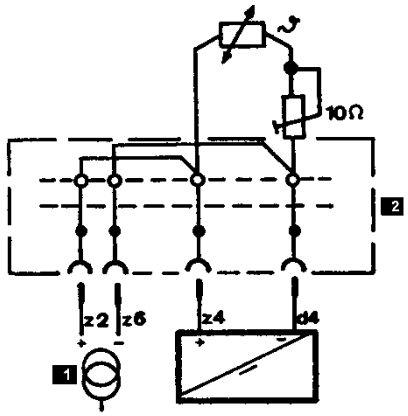


Figure 3: Current Inputs with 12 Bits = 4095 Digits = 21.3 mA

2-Wire Circuit with 1 Pt100 and Line Compensation (Optional)

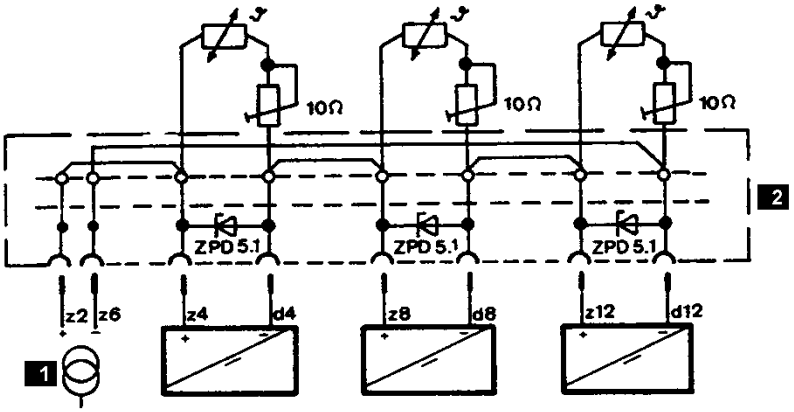
The line compensation must be performed with a corrective calculation in the user program.



1 I_k = 2.5 mA **2** Z 7127/6215/Cx/2P

Figure 4: 2-Wire Circuit with 1 Pt100 and Line Compensation (Optional)

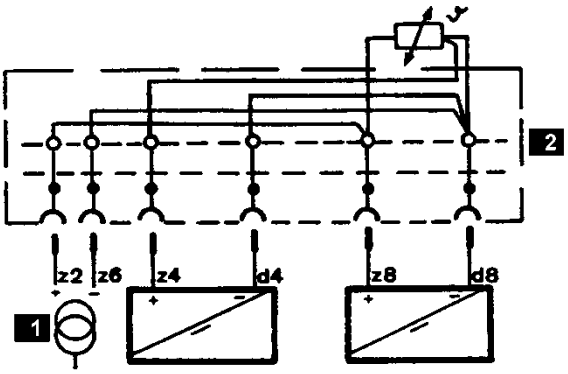
2-Wire Circuit of Several Pt100



1 I_k = 2.5 mA **2** Z 7127/6215/Cx/2P

Figure 5: 2-Wire Circuit with Several Pt100

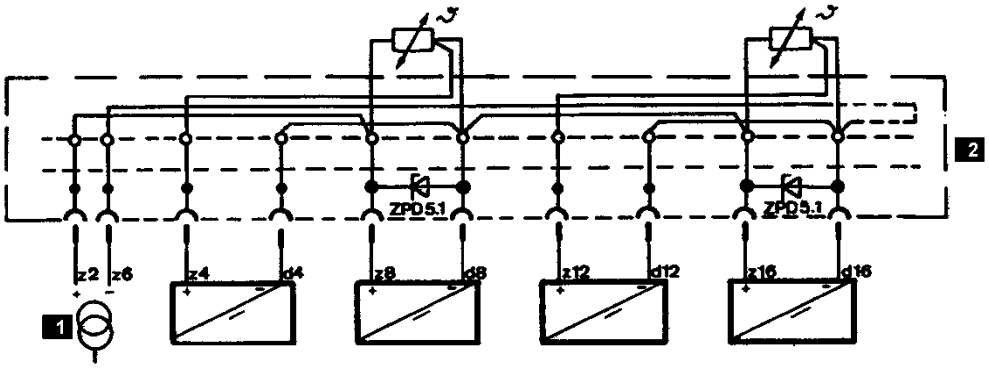
Connecting to 1 Pt100 in 3-Wire Circuit



1 I_k = 2.5 mA **2** Z 7127/6215/Cx/3P

Figure 6: Connection to 1 Pt100 in 3-Wire Circuit

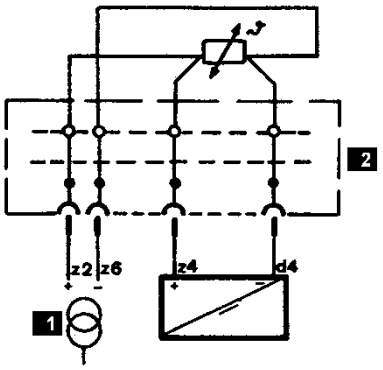
Connecting to Several Pt100 in 3-Wire Circuit



1 I_k = 2.5 mA **2** Z 7127/6215/Cx/3P

Figure 7: Connection to Several Pt100 in 3-Wire Circuit

Connecting to 1 Pt100 in 4-Wire Circuit

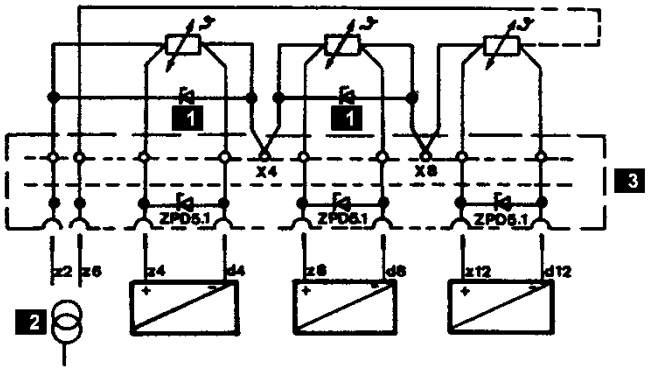


1 I_k = 2.5 mA

2 Z 7127/6215/Cx/4P

Figure 8: Connection to 1 Pt100 in 4-Wire Circuit

Using Several Pt100 in 4-Wire Circuit



1 Additional diode recommended[1)]

2 I_k = 2.5 mA

3 Z 7127/6215/Cx/4P

Figure 9: Use of Several Pt100 in 4-Wire Circuit

[1)] HIMA recommends installing an additional Z-diode (e.g., on terminal blocks) to ensure that the measurement of the ensuing sensor is guaranteed even during failure or replacement of a Pt100.

i The maximum current loop resistance may not exceed 6 kΩ!

Reason: If one Pt100 fails, the proper measurement function of the remaining Pt100 sensors must be ensured.

1 Configuration in SILworX

The module is configured in the Hardware Editor of the SILworX programming tool.

Observe the following points when configuring the module:

- To diagnose the module and channels, both the statuses and the measured value can be evaluated within the user program. For further details on the statuses and parameters, refer to the tables in Chapter 1.1 and following chapters.
- If a redundancy group is created, its configuration is defined in the tabs. The tabs specific to the redundancy group differ from those of the individual modules, see the following tables.

To evaluate the system parameters in the user program, they must be assigned to global variables. Perform this step in the Hardware Editor using the module's detail view.

The following tables present the system parameters for the module in the same order as in the SILworX Hardware Editor.

1.1 The Module Tab

The **Module** tab contains the following system parameters:

System parameter	Data type	R/W	Description
Name	---	W	Module name.
Noise Blanking	BOOL	W	Allow noise blanking performed by the system (Activated/Deactivated). After a transient fault, the system delays the fault response until the safety time. The user program retains its last valid process value. Default setting: Activated (not changeable). Refer to the system manual (HI 803 211 E) for further details on noise blanking.
Mode of Operation		W	Mode of operation for voltage or current measurement: ▪ Two-Wire Circuit ▪ Three-Wire Circuit ▪ Four-Wire Circuit ▪ Current Default setting: Two-Wire Circuit The parameter must match the cable plug in use.
The following statuses and parameters can be assigned global variables and used in the user program.			
Explicitly Triggered Restart Required	BOOL	R	TRUE: The module must be explicitly required to restart. FALSE: ▪ Restart is necessary and the module performs it automatically. ▪ Module in the STOP state. ▪ Connection loss.
Background Test Noise Blanking Active	BOOL	R	TRUE: Error detected by a background test. FALSE: ▪ No errors detected by the background tests. ▪ Module in the STOP state. ▪ Connection loss.
Initialization Active	BOOL	R	TRUE: The module is performing initial tests. FALSE: ▪ The initial tests are complete. ▪ Module in the STOP state. ▪ Connection loss.

<table>
<tr><th>System parameter</th><th>Data type</th><th>R/W</th><th>Description</th></tr>
<tr><td>Module OK</td><td>BOOL</td><td>R</td><td>
<table>
<tr><td>TRUE</td><td>No internal fault detected by the system.</td></tr>
<tr><td>FALSE</td><td>▪ Internal fault detected by the system.
▪ Module in the STOP state.
▪ Connection loss.</td></tr>
</table>
</td></tr>
<tr><td>Module Process Value OK</td><td>BOOL</td><td>R</td><td>
<table>
<tr><td>TRUE</td><td>No channel fault detected by the system.</td></tr>
<tr><td>FALSE</td><td>▪ At least one channel fault detected by the system.
▪ Module in the STOP state.
▪ Connection loss.</td></tr>
</table>
</td></tr>
<tr><td>Restart on Error Suppressed</td><td>BOOL</td><td>W</td><td>Automatic restart after errors can be suppressed by the user.
To cause the automatic restart to be performed after an error, the system parameter must have been set to FALSE for longer than the F-CPU safety time (does not apply to field faults).
<table>
<tr><td>TRUE</td><td>No automatic restart after a module or channel fault.</td></tr>
<tr><td>FALSE</td><td>Automatic restart after a module or channel fault.</td></tr>
</table>
Default setting: FALSE</td></tr>
</table>

Table 4: The **Module** Tab in the Hardware Editor

1.2 The F 6215: Channels Tab

The **F 6215: Channels** tab contains the following system parameters for each channel:

System parameter	Data type	R/W	Description
Channel no.	---	R	Channel number, preset and cannot be changed.
Technical Unit		W	▪ °C ▪ °F ▪ K Default setting: °C
Scaling Factor	REAL	W	Scaling factor that is multiplied by the raw value. Default value: 0.0001
Scaling Offset	REAL	W	Offset added to the raw value. Default value: 0.0
-> Process Value [REAL]	REAL	R	Process value = (*raw value* x *scaling factor*) + *scaling offset*
-> Raw Value [1 mA = 10 000] [DINT]	DINT	R	Unhandled value measured for the channel.
-> Process Value OK [BOOL]	BOOL	R	TRUE: Fault-free channel. No internal fault nor fault on the field side detected. Module initialization successfully completed. FALSE: ▪ Faulty channel. Internal fault or fault on the field side detected. ▪ The initial test has not been completely performed. ▪ Module in the STOP state. ▪ Connection loss.
-> Channel OK [BOOL]	BOOL	R	TRUE: Fault-free channel. FALSE: ▪ Faulty channel. ▪ Module in the STOP state. ▪ Connection loss. An external SC or OC has no influence on *-> Channel OK [BOOL]*. Observe the statuses *-> OC* [BOOL] and *-> SC [BOOL]*!
OC Limit [1mA = 10000]	DINT	W	Threshold in mA for detecting an open-circuit. If the process value falls under *OC Limit*, the module detects an open-circuit. Default value: -2 147 483 648
-> OC [BOOL]	BOOL	R	TRUE: Open-circuit. FALSE: ▪ No open-circuit. ▪ Module in the STOP state. ▪ Connection loss.
SC Limit [1 mA = 10000]	DINT	W	Threshold in mA for detecting a short-circuit. If the process value exceeds *SC Limit*, the module detects a short-circuit. Default value: 2 147 483 647
-> SC [BOOL]	BOOL	R	TRUE: Short-circuit. FALSE: ▪ No short-circuit. ▪ Module in the STOP state. ▪ Connection loss.

<table>
<tr><th>System parameter</th><th>Data type</th><th>R/W</th><th>Description</th></tr>
<tr><td>Redund.</td><td>BOOL</td><td>R</td><td>Requirement: A redundant module must exist.
<table><tr><td>TRUE</td><td>The channel redundancy for this channel is active.</td></tr><tr><td>FALSE</td><td>The channel redundancy for this channel is not active.</td></tr></table>Default setting: FALSE</td></tr>
<tr><td>Line resistance
[1 Ohm = 10000]</td><td>UINT</td><td>W</td><td>Specification of the cable resistance.
Default value: 0</td></tr>
<tr><td>-> Temperature Out of the Operating Range [BOOL]</td><td>BOOL</td><td>R</td><td>The measured temperature is outside the operating range.
<table><tr><td>TRUE</td><td>Operating range exceeded.</td></tr><tr><td>FALSE</td><td>▪ Normal operation.
▪ Module in the STOP state.
▪ Connection loss.</td></tr></table></td></tr>
</table>

Table 5: Tab **F 6215: Channels** in the Hardware Editor

Global variables can be assigned to the system parameters with **->** and used in the user program. The values of the system parameters without **->** must be directly defined.

1.2.1 Description of Diagnostic Entry

The module is automatically tested for errors during operation. The diagnostic entry is not 0 if one or more errors were detected in the module.

Defective modules must be replaced with a faultless module of the same type or with an approved replacement model.

Bit	Coding [1)]	Description
0	0x00000001	Hardware module fault.
1	0x00000002	The module in the slot was not deleted. The slot is either empty or equipped with incorrect module type.
16	0x00010000	Module defective (the error code is for internal purposes only).
…	…	
23	0x00800000	
1) The status may consist of several codings, e.g.: Module status = 0x80000001 (0x00000001 + 0x80000000).		

Table 6: Diagnostic Entry Coding

1.2.2 Channel Status

The channel status byte in the diagnostic entry shows the following status:

Bit	Coding [1)]	Description
0	0x0001	Hardware channel fault. F-IOP indicator: Continuous light of the channel LED.
1	0x0002	Short-circuit (SC). Workaround: Check the channel wiring and the limit values. F-IOP indicator: Blinking1 of the channel LED.
2	0x0004	Open-circuit (OC). Workaround: Check the channel wiring, check and correct the limit values, if required. F-IOP indicator: Blinking1 of the channel LED.
3	0x0008	Faulty measuring values in the Pt100 wiring. Workaround: Check the channel wiring, check and, if required, correct the limit values, check the module's mode of operation. F-IOP indicator: Blinking1 of the channel LED.
1) The status may consist of several codings, e.g.: Channel status = 0x8001 (0x0001 + 0x8000).		

Table 7: Channel Status of the F 6215