

4X70 PROFINET SYSTEM
Status and weight transfer using PROFINET



Applies for:

Software: CONCTR_4.190123.1v3

Document no.: 0123mu4x70-1v3

Date: 2020-10-23

Rev.: 1v3

1) Contents

1) Contents	2
2) Introduction	4
2.1 Introduction	4
2.2 Connection of power supply	4
2.3 ATEX (Ex) specification	4
3) Data Exchange	5
3.1 PROFINET communication	5
3.1.1 Output data	5
3.1.2 Input data (LcSignal, Normal operation, AS=0)	6
3.1.3 Input data (LcSignalFiltered, AS=1)	7
3.1.4 Input data (LcSignalUnFiltered, AS=2)	7
3.1.5 Input data (LcSerialNumber, AS=3)	8
3.1.6 Input data (LcCapacity, AS=4)	8
3.1.7 Input data (LcExponent, AS=5)	9
3.1.8 Input data (TestValue, AS=6)	10
3.1.9 Input data (SoftwareVersion, AS=7)	11
3.2 Data formats	12
3.2.1 Unsigned integer format (16 bit)	12
3.2.2 Signed integer format (32 bit)	12
3.3 Scaling	13
3.4 Measurement time	13
3.5 Filtering	14
4) Data Processing	15
4.1 Zeroing, calibration and weight calculation	15
4.1.1 Zeroing of weighing system	15
4.1.2 Corner calibration of weighing system	16
4.1.3 Calculation of uncalibrated system weight	16
4.1.4 System calibration of weighing system	17
5) Installation of System	18
5.1 Checklist during installation	18
6) Hardware Description	19
6.1 4X70 overview	19
6.2 4X70 front panel description	19
6.2.1 Connection of power	19
6.2.2 Connection of load cells	20
6.2.3 PROFINET connectors	20
6.2.4 SW1 settings	20
6.2.5 SWP settings	20
6.2.6 Light Emitting Diodes (LEDs)	21
6.3 Update times	22
7) Appendices	23
7.1 Appendix A: Connection of power	23
7.1.1 Non-ATEX applications	23
7.1.2 ATEX applications	24
7.2 Appendix B – PROFINET Configuration tips	25
7.2.1 MAC addresses	25
7.2.2 GSDML file	25
7.2.3 Factory settings	25
7.2.4 Setting DeviceName, IP Address etc.	25
7.2.5 Data sizes	25
7.3 Appendix C – Internal Features	26
7.3.1 4070 PROFINET module	26
7.3.2 Connectors	26

7.3.3 Jumper settings.....	27
7.3.4 Light Emitting Diodes (LEDs).....	27
7.3.5 4040 communication module	28
7.3.6 SW2 settings.....	28
7.3.7 Jumper settings.....	28
7.3.8 Light Emitting Diodes (LEDs).....	29
7.4 Appendix D – Status Codes	30

2) Introduction

2.1 Introduction

This document describes the use of a 4X70 PROFINET system unit from Eilersen Electric. The 4X70-system unit consists internally of a 4070 PROFINET module (with the software listed on the front page) and a 4040 communication module.

The 4X70 system unit is connected to X load cells (1-4). With the program specified on the front page, the 4X70 PROFINET unit is capable of transmitting weight and status for up to 4 load cells in a single telegram. The 4X70 PROFINET unit is also capable of transmitting load cell information (such as serial number, capacity and exponent) instead of the normal weight signals. This is all determined by the **Actual Value Selector (AS)** written to the 4X70 PROFINET unit from the PROFINET master.

It is possible to connect the 4X70 PROFINET unit to a PROFINET network, where it will act as a slave. It will then be possible from the PROFINET master to read status and weight for each of the connected load cells. Functions as zeroing, calibration and calculation of system weight(s) must be implemented **outside** the 4X70 in the PROFINET master.

By use of DIP-switches it is possible to select measurement time and include one of 15 different FIR filters, which will be used to filter the load cell signals, as well as selecting the desired scaling of the load cell signals.

Exchange of data between master and slave takes place as described in the following.

2.2 Connection of power supply

IMPORTANT: Connection of power supply (24VDC) MUST be made to BOTH the green two pole power connectors (J2 and J3) as specified on the front panel of the 4x70 unit.

IMPORTANT: In regards to ATEX installations each of the green two pole power connectors (J2 and J3) MUST be connected to EACH of their own SEPARATE power supply as described later; see "7.1 Appendix A: Connection of power".

2.3 ATEX (Ex) specification

IMPORTANT: Instrumentation (the 4X70A) must be placed outside the hazardous zone if the load cells are used in hazardous ATEX (Ex) area. Furthermore, only ATEX certified load cells and instrumentation can be used in ATEX applications.

3) Data Exchange

3.1 PROFINET communication



PROFINET communication with the 4X70 PROFINET unit uses a data module containing 26 input bytes (from the 4x70) and 2 output bytes (to the 4x70) as specified in the GSDML file. In the following the byte order for the individual parts of the telegrams is MSB first. In the following bit 0 will represent the least significant bit in a register.

3.1.1 Output data

The 2 output data bytes (to the 4x70 unit) are structured like this:

Lc Register																
Byte 0 (MSB)								Byte 1 (LSB)								
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
-	-	-	-	AS				-	-	-	-	-	-	-	-	-

LcRegister is a word (two bytes) that constitutes a bit register consisting of 16 bits (bit 0–15). Bit 8-11 in the **LcRegister** (the 4 least significant bits of the most significant byte) are used as an **Actual Value Selector (AS)**.

The other bits in the **LcRegister** of the output data are **NOT** used.

The **Actual Value Selector (AS)** is used as a request to select the actual input data transferred from the 4x70 unit back to the PROFINET master. Once the **AS** in the response coming back from the 4x70 unit matches the **AS** in the request sent to the 4x70 unit, then the PROFINET master knows the data transferred correspond to the requested data. The following data transfers can be requested using the **Actual Value Selector (AS)** and are described in detail below:

Actual Value Selector (AS)	Transfer
0	LcSignal(X) : Load cell signals (normal operation) (filtered and scaled)
1	LcSignalFiltered(X) : Load cell signals (filtered but not scaled)
2	LcSignalUnFiltered(X) : Load cell signals (not filtered and not scaled)
3	LcSerialNumber(X) : Load cell serial numbers
4	LcCapacity(X) : Load cell capacities
5	LcExponent(X) : Load cell exponents
6	TestValue(X) : Test values
7	SoftwareVersion(X) : Software version installed in module.



IMPORTANT: Before using the input data described below, the PROFINET master must ensure the **AS** response value in the input data (from 4x70) matches the **AS** request value in the output data (to 4x70).



3.1.2 Input data (LcSignal, Normal operation, AS=0)

This chapter describes the input data when the **Actual Value Selector (AS)** is set to **0** during normal operation.

The 26 input data bytes (from the 4x70 unit) are structured like this:

Lc Register		Lc Status(0)		Lc Data(0)				Lc Status(3)		Lc Data(3)			
0	1	2	3	4	5	6	7	20	21	22	23	24	25

LcRegister is a word (two bytes) that constitutes a bit register for indication of expected load cells. Hence, bit 0-3 will be ON, if the corresponding load cell address (LC1-LC4) was expected to be connected. **LcRegister** is always transferred in **16 bit unsigned integer** format.

In addition the **LcRegister** also contains the **Actual Value Selector (AS)** as previously described above in the 3.1.1 *Output data*. The **AS** is located in the same bit positions (bit 8-11) in the input data as in the output data.

Furthermore bit 15 will always be ON, while bit 14 will toggle ON and OFF with 1hz (500ms ON, 500ms OFF).

LcStatus(X) is a word (two bytes) that constitute a register containing the actual status for load cell **X**. **LcStatus(X)** is always transferred in **16 bit unsigned integer** format. During normal operation, this register will be 0, but if an error occurs, some bits in the register will be set resulting in an error code. A description of the different error codes can be found in *Appendix D – Status Codes*.

LcData(X) is a double word (four bytes) constituting a register, which during normal operation (**AS=0**) contains the **LcSignal(X)**. The **LcSignal(X)** is the actual weight signal from load cell **X** in **32 bit signed integer** format. Note that the **LcSignal(X)** value is only valid if the corresponding **LcStatus(X)** register is 0 indicating no error present. Also note the **LcSignal(x)** transferred during normal operation is filtered and scaled using the selected DIP switch settings (**SWP**) as described below.

Since only status and weight for the load cells are transmitted in the telegram, functions such as status handling, calculation of system weight(s), zeroing and calibration **must** be implemented on the PROFINET master. Please refer to the chapter 4) *Data Processing* for an explanation on how this typically can be done.

3.1.3 Input data (LcSignalFiltered, AS=1)



This chapter describes the input data when the **Actual Value Selector (AS)** is set to **1** during transfer of **LcSignalFiltered(X)**. The 26 input data bytes (from the 4x70 unit) are structured exactly like during normal operation (**AS=0**), except for the differences listed in the following:

LcRegister is 100% identical to **LcRegister** during normal operation (**AS=0**), except the **AS** will be set to **1**.

LcStatus(X) is 100% identical to **LcStatus(X)** during normal operation (**AS=0**), except the **LcStatus(X)**, will always have a bit set (see 7.4 Appendix D - Status Codes) stating that **LcSignal(X)** is **NOT** selected (i.e. normal operation NOT selected).

LcData(X) will contain **LcSignalFiltered(X)** in the double word instead of **LcSignal(X)** which is transferred during normal operation (**AS=0**). The **LcSignalFiltered(X)** is the "raw" filtered signal from load cell **X**, which means it is the load cell signal with filtering but without any scaling (based on the **LcExponent(X)**) selected using the DIP switch settings (**SWP**).

3.1.4 Input data (LcSignalUnFiltered, AS=2)



This chapter describes the input data when the **Actual Value Selector (AS)** is set to **2** during transfer of **LcSignalUnFiltered(X)**. The 26 input data bytes (from the 4x70 unit) are structured exactly like during normal operation (**AS=0**), except for the differences listed in the following:

LcRegister is 100% identical to **LcRegister** during normal operation (**AS=0**), except the **AS** will be set to **2**.

LcStatus(X) is 100% identical to **LcStatus(X)** during normal operation (**AS=0**), except the **LcStatus(X)**, will always have a bit set (see 7.4 Appendix D - Status Codes) stating that **LcSignal(X)** is **NOT** selected (i.e. normal operation NOT selected).

LcData(X) will contain **LcSignalUnFiltered(X)** in the double word instead of **LcSignal(X)** which is transferred during normal operation (**AS=0**). The **LcSignalUnFiltered(X)** is the "raw" unfiltered signal from load cell **X**, which means it is the load cell signal without any filtering or scaling (based on the **LcExponent(X)**) selected using the DIP switch settings (**SWP**).

3.1.5 Input data (LcSerialNumber, AS=3)



This chapter describes the input data when the **Actual Value Selector (AS)** is set to **3** during transfer of **LcSerialNumber(X)**. The 26 input data bytes (from the 4x70 unit) are structured exactly like during normal operation (**AS=0**), except for the differences listed in the following:

LcRegister is 100% identical to **LcRegister** during normal operation (**AS=0**), except the **AS** will be set to **3**.

LcStatus(X) is 100% identical to **LcStatus(X)** during normal operation (**AS=0**), except the **LcStatus(X)**, will always have a bit set (see 7.4 Appendix D – Status Codes) stating that **LcSignal(X)** is **NOT** selected (i.e. normal operation NOT selected).

LcData(X) will contain **LcSerialNumber(X)** in the double word instead of **LcSignal(X)** which is transferred during normal operation (**AS=0**). The **LcSerialNumber(X)** is the serial number from load cell **X**. The **LcSerialNumber(X)** is transferred as a 7 digit decimal number, and has the format **YYXXXXX** corresponding to the serial number (**YY-XXXXX**) marked on the load cell itself.

3.1.6 Input data (LcCapacity, AS=4)



This chapter describes the input data when the **Actual Value Selector (AS)** is set to **4** during transfer of **LcCapacity(X)**. The 26 input data bytes (from the 4x70 unit) are structured exactly like during normal operation (**AS=0**), except for the differences listed in the following:

LcRegister is 100% identical to **LcRegister** during normal operation (**AS=0**), except the **AS** will be set to **4**.

LcStatus(X) is 100% identical to **LcStatus(X)** during normal operation (**AS=0**), except the **LcStatus(X)**, will always have a bit set (see 7.4 Appendix D – Status Codes) stating that **LcSignal(X)** is **NOT** selected (i.e. normal operation NOT selected).

LcData(X) will contain **LcCapacity(X)** in the double word instead of **LcSignal(X)** which is transferred during normal operation (**AS=0**). The **LcCapacity(X)** is the capacity of the load cell in internal divisions. In order to get the load cell capacity in SI units as stated on the load cell itself, the **LcExponent(X)** must be taken into account.

3.1.7 Input data (LcExponent, AS=5)



This chapter describes the input data when the **Actual Value Selector (AS)** is set to **5** during transfer of **LcExponent(X)**. The 26 input data bytes (from the 4x70 unit) are structured exactly like during normal operation (**AS=0**), except for the differences listed in the following:

LcRegister is 100% identical to **LcRegister** during normal operation (**AS=0**), except the **AS** will be set to **5**.

LcStatus(X) is 100% identical to **LcStatus(X)** during normal operation (**AS=0**), except the **LcStatus(X)**, will always have a bit set (see 7.4 Appendix D – Status Codes) stating that **LcSignal(X)** is **NOT** selected (i.e. normal operation NOT selected).

LcData(X) will contain **LcExponent(X)** in the double word instead of **LcSignal(X)** which is transferred during normal operation (**AS=0**). The **LcExponent(X)** is a fixed value for the load cell used for internal scaling of the raw load cell signal into SI units. This is done according to the following:

Exponent [Decimal]	Exponent [Hexadecimal]	SI unit	Conversion to gram
-3	0xFFFFFFFFD	mg	*10 ⁻³
-2	0xFFFFFFFFE		*10 ⁻²
-1	0xFFFFFFFFF		*10 ⁻¹
0	0x00000000	gram	*10 ⁰
1	0x00000001		*10 ¹
2	0x00000002		*10 ²
3	0x00000003	Kg	*10 ³



3.1.8 Input data (TestValue, AS=6)

This chapter describes the input data when the **Actual Value Selector (AS)** is set to **6** during transfer of **TestValue(X)**. The 26 input data bytes (from the 4x70 unit) are structured exactly like during normal operation (**AS=0**), except for the differences listed in the following:

LcRegister is 100% identical to **LcRegister** during normal operation (**AS=0**), except the **AS** will be set to **6**.

LcStatus(X) is 100% identical to **LcStatus(X)** during normal operation (**AS=0**), except the **LcStatus(X)**, will always have a bit set (see 7.4 Appendix D – Status Codes) stating that **LcSignal(X)** is **NOT** selected (i.e. normal operation NOT selected).

LcData(X) will contain **TestValue(X)** in the double word instead of **LcSignal(X)** which is transferred during normal operation (**AS=0**). The **TestValue(X)** are fixed hardcoded values, which can be used for testing data handling on the PROFINET master. The values transferred are the following:

TestValue(X)	Value [Decimal]	Value [Hexadecimal]
TestValue(0)	123456	0x0001E240
TestValue(1)	-123456	0xFFFE1DC0
TestValue(2)	12345	0x00003039
TestValue(3)	-12345	0xFFFFCFC7



3.1.9 Input data (SoftwareVersion, AS=7)

This chapter describes the input data when the **Actual Value Selector (AS)** is set to **7** during transfer of **SoftwareVersion(X)**. The 26 input data bytes (from the 4x70 unit) are structured exactly like during normal operation (**AS=0**), except for the differences listed in the following:

LcRegister is 100% identical to **LcRegister** during normal operation (**AS=0**), except the **AS** will be set to **7**.

LcStatus(X) is 100% identical to **LcStatus(X)** during normal operation (**AS=0**), except the **LcStatus(X)**, will always have a bit set (see 7.4 Appendix D - Status Codes) stating that **LcSignal(X)** is **NOT** selected (i.e. normal operation NOT selected).

LcData(X) will contain **SoftwareVersion(X)** in the double word instead of **LcSignal(X)** which is transferred during normal operation (**AS=0**). The **SoftwareVersion(X)** are fixed values making up the different parts of the software version (date, major version and minor version) installed in the module. The values transferred are the following:

SoftwareVersion(X)	Contains	Description
SoftwareVersion(0)	Date	The date part of the software version
SoftwareVersion(1)	Major ver.	The major version part of the software version
SoftwareVersion(2)	Minor ver.	The minor version part of the software version
SoftwareVersion(3)	0	Unused - Reserved for future use

For the software version covered by this manual (**CONCTR_4.190123.1v3**), the **SoftwareVersion(X)** will contain:

SoftwareVersion(X)	Contains
SoftwareVersion(0)	190123
SoftwareVersion(1)	1
SoftwareVersion(2)	3

3.2 Data formats

The PROFINET communication can transfer data in the following three data formats. Please refer to other literature for further information on these formats as it is outside the scope of this document.

3.2.1 Unsigned integer format (16 bit)

The following are examples of decimal numbers represented on 16 bit unsigned integer format:

Decimal	Hexadecimal	Binary (MSB first)
0	0x0000	00000000 00000000
1	0x0001	00000000 00000001
2	0x0002	00000000 00000010
200	0x00C8	00000000 11001000
2000	0x07D0	00000111 11010000
20000	0x4E20	01001110 00100000

3.2.2 Signed integer format (32 bit)

The following are examples of decimal numbers represented on 32 bit signed integer format:

Decimal	Hexadecimal	Binary (MSB first)
-20000000	0xFECED300	11111110 11001110 11010011 00000000
-2000000	0xFFE17B80	11111111 11100001 01111011 10000000
-200000	0xFFFFCF2C0	11111111 11111100 11110010 11000000
-20000	0xFFFFFB1E0	11111111 11111111 10110001 11100000
-2000	0xFFFFF830	11111111 11111111 11111000 00110000
-200	0xFFFFF38	11111111 11111111 11111111 00111000
-2	0xFFFFF8FE	11111111 11111111 11111111 11111110
-1	0xFFFFF8FF	11111111 11111111 11111111 11111111
0	0x00000000	00000000 00000000 00000000 00000000
1	0x00000001	00000000 00000000 00000000 00000001
2	0x00000002	00000000 00000000 00000000 00000010
200	0x000000C8	00000000 00000000 00000000 11001000
2000	0x000007D0	00000000 00000000 00000111 11010000
20000	0x00004E20	00000000 00000000 01001110 00100000
200000	0x00030D40	00000000 00000011 00001101 01000000
2000000	0x001E8480	00000000 00011110 10000100 10000000
20000000	0x01312D00	00000001 00110001 00101101 00000000

3.3 Scaling

By use of a DIP-switch, it is possible to select the desired scaling of the weight signals. The scaling of the weight signals on the PROFINET is determined by **SWP.1** - **SWP.2** as follows, where the table shows how a given weight is represented on the PROFINET depending on switch settings:

Weight [gram]	SWP.1 = OFF SWP.2 = OFF (1 gram)	SWP.1 = ON SWP.2 = OFF (1/10 gram)	SWP.1 = OFF SWP.2 = ON (1/100 gram)	SWP.1 = ON SWP.2 = ON (10 gram)
1,0	1	10	100	0
123,4	123	1234	12340	12
12341	12341	123410	1234100	1234

3.4 Measurement time

By use of DIP-switches, it is possible to choose between four different measurement times. All load cells are sampled/averaged over a measurement period determined by **SWP.3** and **SWP.4** as follows:

SWP.4	SWP.3	Measurement time
OFF	OFF	20 ms
OFF	ON	100 ms
ON	OFF	200 ms
ON	ON	400 ms

The hereby found load cell signals (possibly filtered) are used on the PROFINET until new signals are achieved when the next sample period expires.

3.5 Filtering

By use of DIP-switches, it is possible to include one of 15 different FIR filters, which will be used to filter the load cell signals. Thus it is possible, to send the unfiltered load cell signals achieved over the selected measurement period through one of the following FIR filters, before the results are transmitted on the PROFINET:

SWP.5	SWP.6	SWP.7	SWP.8	No.	Taps	Frequency		Damping
						Tavg = 20ms	Tavg = 200ms	
OFF	OFF	OFF	OFF	0	-	-	-	-
ON	OFF	OFF	OFF	1	7	12.0 Hz	1.2 Hz	-60dB
OFF	ON	OFF	OFF	2	9	10.0 Hz	1.0 Hz	-60dB
ON	ON	OFF	OFF	3	9	12.0 Hz	1.2 Hz	-80dB
OFF	OFF	ON	OFF	4	12	8.0 Hz	0.8 Hz	-60dB
ON	OFF	ON	OFF	5	12	10.0 Hz	1.0 Hz	-80dB
OFF	ON	ON	OFF	6	15	8.0 Hz	0.8 Hz	-80dB
ON	ON	ON	OFF	7	17	6.0 Hz	0.6 Hz	-60dB
OFF	OFF	OFF	ON	8	21	6.0 Hz	0.6 Hz	-80dB
ON	OFF	OFF	ON	9	25	4.0 Hz	0.4 Hz	-60dB
OFF	ON	OFF	ON	10	32	4.0 Hz	0.4 Hz	-80dB
ON	ON	OFF	ON	11	50	2.0 Hz	0.2 Hz	-60dB
OFF	OFF	ON	ON	12	64	2.0 Hz	0.2 Hz	-80dB
ON	OFF	ON	ON	13	67	1.5 Hz	0.15 Hz	-60dB
OFF	ON	ON	ON	14	85	1.5 Hz	0.15 Hz	-80dB
ON	ON	ON	ON	15	100	1.0 Hz	0.10 Hz	-60dB

NOTE: With all switches OFF no filtering is performed.

4) Data Processing

4.1 Zeroing, calibration and weight calculation

Calculation of system weight(s) is done by addition of the weight registers for the load cells belonging to the system. This is explained below. **Note** that the result is only valid if all status registers for the load cells in question indicate no errors. It should also be noted that it is up to the master to ensure the usage of consistent load cell data when calculating the system weight (the used data should come from the same telegram).

4.1.1 Zeroing of weighing system

Zeroing of a weighing system (all load cells in the specific system) should be performed as follows, taking into account that no load cell errors may be present during the zeroing procedure:

- 1) The weighing arrangement should be empty and clean.
- 2) The PROFINET master verifies that no load cell errors are present, after which it reads and stores the actual weight signals for the load cells of the actual system in corresponding zeroing registers:

$$\text{LcZero}[x] = \text{LcSignal}[x]$$

- 3) After this the uncalibrated gross weight for load cell **X** can be calculated as:

$$\text{LcGross}[X] = \text{LcSignal}[X] - \text{LcZero}[X]$$

4.1.2 Corner calibration of weighing system

In systems where the load is not always placed symmetrically the same place (for example a platform weight where the load can be placed randomly on the platform when a weighing is to take place), a fine calibration of a systems corners can be made, so that the weight indicates the same independent of the position of the load. This is done as follows:

- 1) Check that the weighing arrangement is empty. Zero the weighing system.
- 2) Place a known load ($CalLoad$) directly above the load cell that is to be corner calibrated.
- 3) Calculate the corner calibration factor that should be multiplied on the uncalibrated gross weight of the load cell in order to achieve correct showing as:

$$CornerCalFactor[x] = (CalLoad) / (LcGross[x])$$

After this, the determined corner calibration factor is used to calculate the calibrated gross weight of the load cell as follows:

$$LcGrossCal[x] = CornerCalFactor[x] * LcGross[x]$$

4.1.3 Calculation of uncalibrated system weight

Based on the load cell gross values ($LcGross[x]$ or $LcGrossCal[x]$), whether they are corner calibrated or not, an uncalibrated system weight can be calculated as either:

$$Gross = LcGross[X1] + LcGross[X2] + \dots$$

or:

$$Gross = LcGrossCal[X1] + LcGrossCal[X2] + \dots$$

4.1.4 System calibration of weighing system

Based on the uncalibrated system weight a system calibration can be made as follows:

- 1) Check that the weighing arrangement is empty. Zero the weighing system.
- 2) Place a known load (`CalLoad`) on the weighing arrangement.
- 3) Calculate the calibration factor that should be multiplied on the uncalibrated system weight in order to achieve correct showing as:

$$\text{CalFactor} = (\text{CalLoad}) / (\text{Actual Gross})$$

After this, the determined calibration factor is used to calculate the calibrated system weight as follows:

$$\text{GrossCal} = \text{CalFactor} * \text{Gross}$$

If the determined calibration factor falls outside the interval 0.9 to 1.1, it is very likely that there is something wrong with the mechanical part of the system. This does not however apply to systems that do not have a load cell under each supporting point. For example on a three legged tank with only one load cell, you should get a calibration factor of approximately 3 because of the two "dummy" legs.

5) Installation of System

5.1 Checklist during installation

During installation of the system, the following should be checked:

1. All hardware connections are made as described below.
2. If necessary, the PROFINET master should be configured to communicate with the 4X70 PROFINET unit using the supplied GSDML file.
3. Set the scaling/resolution of the weight signal by use of **SWP.1 - SWP.2** as described earlier.
4. Set the desired measurement time by use of **SWP.3 - SWP.4** as described earlier.
5. Select the desired filter by use of **SWP.5 - SWP.8** as described earlier.
6. The load cells are mounted mechanically and connected to BNC connectors in the front panel of the 4X70 unit.
7. The 4X70 PROFINET unit is connected to the PROFINET network using the PORT1 PROFINET connectors (and possibly PORT2) in the front panel.
8. Power (24VDC) is applied at the 2 pole power connectors in the front panel of the 4X70 unit as described in the hardware section, and the PROFINET communication is started.
9. Verify that the BF, SF, MT and ST lamps of the 4x70 unit end up OFF.
10. Verify that the RDY lamp ends up green.
11. Verify that the TxLC lamp (yellow) is "slightly" lit (turns on after approx. 5 seconds).
12. Verify that the TxBB lamp (green) is lit (after 10 seconds).
13. Verify that NONE of the 1, 2, 3 or 4 lamps (red) are lit.
14. Verify that the 4X70 PROFINET system unit has found the correct load cells (LcRegister), and that no load cell errors are indicated (LcStatus(x)).
15. Verify that every load cell gives a signal (LcSignal(x)) by placing a load directly above each load cell one after the other (possibly with a known load).

The system is now installed and a zero and fine calibration is made as described earlier. Finally verify that the weighing system(s) returns a value corresponding to a known actual load.

Note that in the above checklist no consideration has been made on which functions are implemented on the PROFINET master.

6) Hardware Description

6.1 4X70 overview

The following figure is an overview of a 4X70 PROFINET system unit with 4 load cell connections (i.e. a 4470 system unit):



6.2 4X70 front panel description

This chapter describes the connections, DIP-switch settings and lamp indications that are available on the front panel of the 4X70 system unit.

6.2.1 Connection of power

The 4X70 system unit is powered by applying +24VDC on **BOTH** the green two pole connectors (**J2** and **J3**) as specified on the front panel of the 4X70 system unit. This powers the entire 4X70 system unit including the load cells.

IMPORTANT: The used power supply must be stable and free of transients. It may therefore be necessary to use a separate power supply dedicated to the weighing system, and not connected to any other equipment.

NOTE: If the load cells are to be placed inside an EX area, then the 4X70 system unit itself **MUST** be placed outside the EX area, and the 4X70 system unit **MUST** be supplied as follows:

- 1) The 2 pole connector (**J3**), located to the right above the 4 pole DIP-switch block, **MUST** be powered by a 4051A power supply (+24VDC ATEX approved) from Eilersen Electric.
- 2) The 2 pole connector (**J2**), located to the left above the RJ45 Ethernet connector, **MUST** be powered by a separate +24VDC, that has **NO** connection to the ATEX approved +24VDC from the above mentioned 4051A power supply.

NOTE: In **7.1 Appendix A: Connection of power** figures are showing how power supply is connected to Non-ATEX and ATEX applications respectively.

6.2.2 Connection of load cells

The load cells must be connected to the available BNC connectors in the front panel of the 4X70 system unit. The load cells are connected starting with the connector marked 1 and continuing onwards in rising order. Thus if three load cells are to be connected, they should be connected to the BNC connectors marked 1, 2 and 3.

6.2.3 PROFINET connectors

The front panel of the 4X70 system unit is equipped with two standard Ethernet RJ45 connectors (**PORT1** and **PORT2**) for PROFINET connection using Cat5 cables.

6.2.4 SW1 settings

The front panel of the 4X70 system unit is equipped with a 4 pole DIP switch block named SW1. These switches are mounted on the 4040 communication module, and they are **ONLY** read during power-on.

SWITCH	FUNCTION
<i>Sw1.1-Sw1.4</i>	<i>Reserved for future use</i>

6.2.5 SWP settings

The front panel of the 4X70 system unit is equipped with an 8 pole DIP switch block named **SWP**. This DIP switch block has the following function:

SWITCH	FUNCTION
SWP.1 - SWP.2	Scaling Used to select the desired scaling as described above.
SWP.3 - SWP.4	Measurement time Used to select the desired measurement time as described above.
SWP.5 - SWP.8	Filtering Used to select the desired filter as described above.

6.2.6 Light Emitting Diodes (LEDs)

The front panel of the 4X70 system unit is equipped with a number of status lamps (light emitting diodes). These have the following functionality:

LED	FUNCTION
PORT1 connector (Green) (RJ45)	Link (PORT1) PROFINET is connected.
PORT1 connector (Yellow) (RJ45)	Activity (PORT1) PROFINET data is received or transmitted.
PORT2 connector (Green) (RJ45)	Link (PORT2) PROFINET is connected.
PORT2 connector (Yellow) (RJ45)	Activity (PORT2) PROFINET data is received or transmitted.
BF (Red)	Bus Fail LED The 4070 Bus Fail LED can be lit/flashing depending on the status of the network. The function of the BF LED is given below.
SF (Red)	System Fail LED The 4070 System Fail LED can be lit/flashing depending on the status of the system. The function of the SF LED is given below.
MT (Yellow)	MainTenance required LED The 4070 MainTenance required LED can be lit/flashing depending on the status of the system. The function of the MT LED is given below.
RDY (Green)	ReaDY LED The 4070 device ReaDY LED can be lit/flashing depending on the status of the device. The function of the RDY LED is given below.
ST (Red)	STatus LED The 4070 STatus LED can be lit/flashing depending on the status of the system. The function of the ST LED is given below.
TxLC (Yellow)	4040 communication with load cells 4040 comm. module is communicating with load cells.
TxBB (Green)	4040 comm. with 4070 PROFINET module (internal) 4040 comm. module is transmitting to 4070 PROFINET module.
1 (Red)	Status for load cell 1 Bad connection, load cell not ready or other error detected.
2 (Red)	Status for load cell 2 Bad connection, load cell not ready or other error detected.
3 (Red)	Status for load cell 3 Bad connection, load cell not ready or other error detected.
4 (Red)	Status for load cell 4 Bad connection, load cell not ready or other error detected.

The BF, SF, MT and RDY LED's display the status of the PROFINET device, and can in conjunction with the table below be used for error finding.

LED	Color	Status	Description
BF	Red		Bus Fail:
		ON	No link status available.
		Flashing	Link status ok. No communication link to a PROFINET IO controller.
	OFF	The PROFINET IO controller has an active communication link to this PROFINET IO device.	
SF	Red		System Fail:
		ON	PROFINET diagnostic exists.
		Flashing	Reserved.
	OFF	No PROFINET diagnostic.	
MT	Yellow		Maintenance Required:
		ON	Manufacturer specific - depends on the capabilities of the device.
		Flashing	
OFF			
RDY	Green		Device Ready:
		ON	TPS-1 has started correctly.
		Flashing	TPS-1 is waiting for synchronization of the host CPU (firmware start is complete).
	OFF	TPS-1 has not started correctly.	

The ST LED blinks red (on time 250ms; off time 250ms) a number of times corresponding to the error detected by the PROFINET device. If multiple errors are detected at the same time, the ST LED will cyclic blink the different errors as each error (flash sequence) is separated by a 2 second off period. The following errors can be indicated by the ST LED:

Number of blinks on ST LED (250 ms)	Description
0	No errors detected
1	Error detected on load cell 1
2	Error detected on load cell 2
3	Error detected on load cell 3
4	Error detected on load cell 4

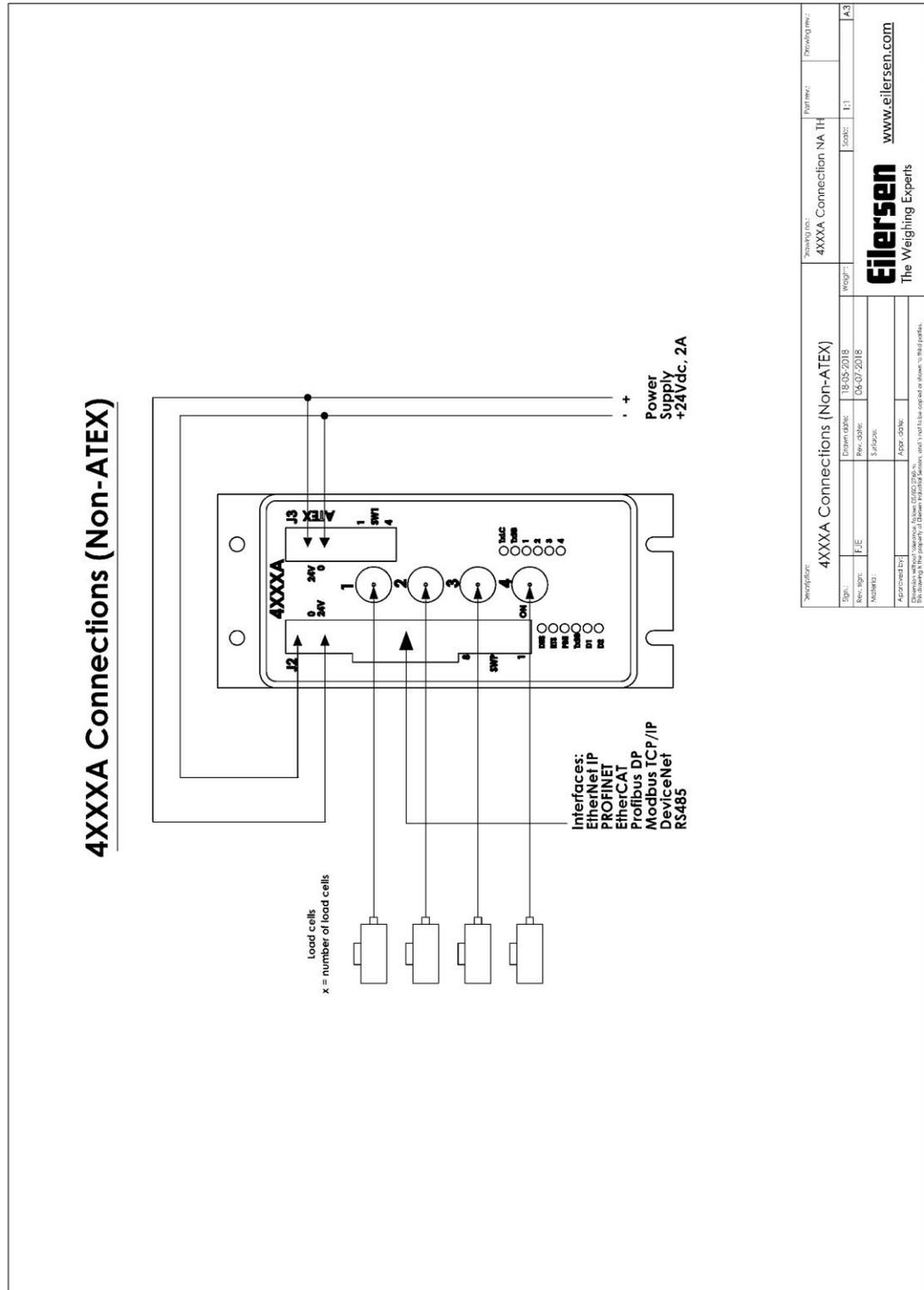
6.3 Update times

The 4X70 PROFINET system unit samples the load cell signals over a period of 20 ms or 200 ms. The hereby found load cell signals are used in the PROFINET communication until new signals are achieved when the next sample period expires. Update times across the PROFINET communication depends on the specific PROFINET configuration (switches, number of units, master scan times etc.) and are beyond the scope of this document.

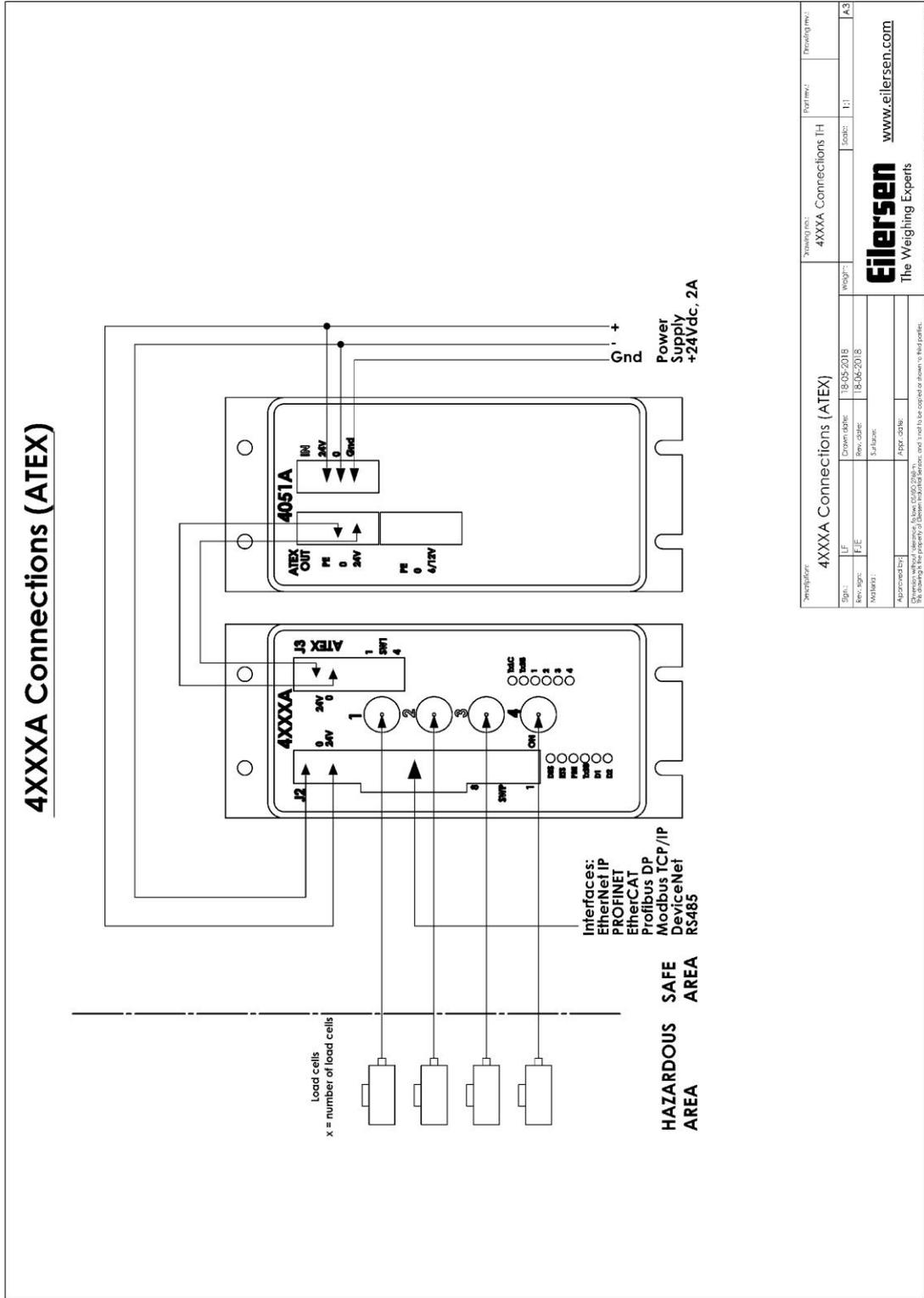
7) Appendices

7.1 Appendix A: Connection of power

7.1.1 Non-ATEX applications



7.1.2 ATEX applications



7.2 Appendix B – PROFINET Configuration tips

7.2.1 MAC addresses

The MAC addresses of the 4x70 PROFINET unit are noted on a label on the side of the 4x70 unit. The MAC addresses of the 4x70 unit are preset to unique values within the Eilersen Electric A/S range.

7.2.2 GSDML file

The supplied GSDML can be used to configure the PROFINET master to communicate with the 4x70 PROFINET unit.

Please note that on a Siemens SIMATIC STEP 7 software platform, once the GSDML file has been imported, the imported 4x70 PROFINET unit will normally be placed in the following location of the "Hardware catalog":

Other field devices \ PROFINET IO \ I/O \ Eilersen Electric \ 4x70 CONCTR_4

7.2.3 Factory settings

Upon delivery the 4x70 PROFINET unit contains the following default factory settings:

Device Name:	d4x70
IP Address:	192.168.1.199
Subnet Mask:	255.255.255.0
Default Gateway:	192.168.1.254
Vendor ID:	840 (0x348)
Device Type:	D4x70

7.2.4 Setting DeviceName, IP Address etc.

The default factory settings of the 4x70 PROFINET unit, such as device name (d4x70) and IP address (192.168.1.199) etc., must be changed according to the actual PROFINET configuration.

Please note that on a Siemens SIMATIC STEP 7 software platform (TiA Portal), this is normally done under "Online Access" where the different node parameters (MAC address, IP address, DeviceName etc.) can be viewed and possibly changed.

7.2.5 Data sizes

The amount of data exchanged between the PROFINET master and the 4x70 PROFINET unit is specified in the GSDML file. This application with the software specified on the front page of the manual uses 26 input bytes and 2 output bytes.

NOTE: Please beware that the terms "input" and "output" may be confusing and are used differently from vendor to vendor. Throughout this manual, these terms are always from the PROFINET masters (PLC's) point of view. Therefore, the data from the 4x70 unit to the PLC are referred to as "input" data, while the data from the PLC to the 4x70 unit are referred to as "output" data.

7.3 Appendix C – Internal Features

7.3.1 4070 PROFINET module

This chapter describes possible connections, jumper settings and LEDs that are available internally on the 4070 PROFINET module. Jumpers will normally be set from Eilersen Electric and should only be changed in special situations.

7.3.2 Connectors

The 4070 PROFINET module is internally equipped with connectors (and pin rows). These connectors have the following function:

CONNECTORS	FUNCTION
J1	14 pin connector <i>Reserved for future direct connection of 4015 module.</i>
J7	14 pin connector for 4040 connection Used for connection to 4040 module for load cell connection.
J21	STM32 JTAG connector (pin row) <i>Not used.</i>
J8	STM32 UART1 connector (pin row) This connector is used when downloading new software to the 4070 module using the JP12 jumper.
J9	TPS-1 JTAG connector (pin row) <i>Not used.</i>
J6	TPS-1 UART6 connector (pin row) <i>Not used.</i>

7.3.3 Jumper settings

The 4070 PROFINET module is internally equipped with 6 jumpers. These jumpers have the following function:

JUMPER	FUNCTION
JP11	STM32 RESET The jumper allows reset of the onboard STM32 microcontroller. OFF: Normal operation (normal setting from factory) ON: Reset of the 4070 on-board microcontroller
JP12	STM32 BOOT0 The jumper is used when downloading new software to the 4070 module using the J8 serial connector. OFF: Normal power-up/operation (normal setting from factory) ON: Download operation possible
P2	STM32 configuration jumper (Reserved for future use)
P3	STM32 configuration jumper (Reserved for future use)
JP1	TPS-1 RESET Not used. Must be in OFF position.
JP2	TPS-1 BOOT1 Not used. Must be in OFF position.

7.3.4 Light Emitting Diodes (LEDs)

The 4070 PROFINET module is internally equipped with 5 LEDs. These LEDs have the following functionality:

LED	FUNCTION
D3 (Red)	Reserved for future use
D4 (Yellow)	RS485 RX Data is received from 4040.
D8 (Red)	RS485 Enable Transmission to the 4040 is enabled.
D9 (Green)	RS485 TX Data is transmitted to the 4040.
D10 (Green)	Power 3.3 VDC internal power supply is on.

7.3.5 4040 communication module

For information on jumper settings, DIP-switch settings, LED status lamps etc. on the 4040 communication module that is not covered in the above or below, please refer to the separate documentation that describes the 4040 communication module and its specific software.

7.3.6 SW2 settings

The 4040 communication module is internally equipped with an 8 pole DIP switch block named SW2. Please note that these switches are **ONLY** read during power-on. This DIP switch block has the following function when the 4040 communication module is equipped with standard program:

Sw2.1	Sw2.2	Sw2.3	Number of load cells
OFF	OFF	OFF	1
ON	OFF	OFF	1
OFF	ON	OFF	2
ON	ON	OFF	3
OFF	OFF	ON	4
ON	OFF	ON	5
OFF	ON	ON	6
ON	ON	ON	6

SWITCH	FUNCTION
Sw2.4-Sw2.8	Reserved for future use

7.3.7 Jumper settings

The 4040 communication module is internally equipped with 4 jumpers named P2, P3, P4 and P5. In this system, these jumpers must be set as follows:

JUMPER	POSITION
P2	OFF (Load cell connected to 4040 NOT accessible using SEL1)
P3	OFF (Load cell connected to 4040 NOT accessible using SEL6)
P4	OFF (Load cell connected to 4040 NOT accessible using SEL1)
P5	OFF (Load cell connected to 4040 NOT accessible using SEL6)

7.3.8 Light Emitting Diodes (LEDs)

The 4040 communication module is internally equipped with a number of status lamps (light emitting diodes). The lamps have the following functionality when the 4040 communication module is equipped with standard program:

LED	FUNCTION
<i>D11 (Red)</i>	<i>Reserved for future use</i>
<i>D12 (Red)</i>	<i>Reserved for future use</i>
<i>D13 (Red)</i>	<i>Reserved for future use</i>
<i>D14 (Red)</i>	<i>Reserved for future use</i>

7.4 Appendix D – Status Codes

Status codes for the connected load cells are shown as a 4 digit hex number. If more than one error condition is present, the error codes are OR'ed together.

CODE (Hex)	CAUSE
0001	<i>Reserved for future use</i>
0002	<i>Reserved for future use</i>
0004	<i>Reserved for future use</i>
0008	<i>Reserved for future use</i>
0010	<i>Reserved for future use</i>
0020	<i>Reserved for future use</i>
0040	<i>Reserved for future use</i>
0080	No answer from load cell Bad connection between load cell and 4015 load cell module? Bad connection between 4015 load cell module and 4040 communication module? Bad connection between 4040 communication module and 4070 module? Bad setting of DIP switches on 4040 communication module?
0100	<i>Reserved for future use</i>
0200	<i>Reserved for future use</i>
0400	<i>Reserved for future use</i>
0800	No load cell answer Bad connection between 4040 communication module and 4070 module?
1000	Normal operation NOT selected LcSignal(X) NOT transferred as normal operation is NOT selected! This is NOT a real load cell error, but an indication that the Actual Value Selector (AS) is set to a value different from 0 by the PLC.
2000	<i>Reserved for future use</i>
4000	<i>Reserved for future use</i>
8000	<i>Reserved for future use</i>

Please note that the above listed status codes are valid when the 4040 communication module is equipped with standard program.