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4x50 ETHERNET SYSTEM

Status and weight transfer using EtherNetIP

Applies for:

Software: EtherNetIP.190129.1v6

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1) Contents

2) Introduction

2.1 Introduction

This document describes the use of a 4x50 Ethernet system unit from Eilersen Electric. The 4x50 system unit consists internally of a 4050 Ethernet module (with the software listed on the front page) and a 4040 communication module.

The 4x50 system unit is connected to X load cells (1-4). With the program specified on the front page, the 4x50 Ethernet unit is capable of transmitting weight and status for up to 4 load cells in a single telegram. The 4x50 Ethernet 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 4x50 Ethernet unit from the EtherNetIP master.

It is possible to connect the 4x50 Ethernet unit to an EtherNetIP network, where it will act as a slave. It will then be possible from the EtherNetIP 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 4x50 in the EtherNetIP 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 4x50 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 4x50A) 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.

2.4 EtherNetIP specification

The EtherNetIP unit confirms with the following EtherNetIP specifications:

Protocol:	EtherNetIP
Media:	Ethernet
Module type:	Slave(/Target)
Communication settings	10MB/s, Half duplex
IP-Address:	Fixed (default: 192.168.1.199)
Ethernet connection:	RJ45/Cat5
System setup:	Ethernet using EEConnect software
Software download:	Ethernet using EEConnect software

3) Data Exchange

3.1 EtherNetIP communication

EtherNetIP communication with the 4x50 Ethernet unit uses a single Assembly consisting of 2 **output** bytes (to the 4x50) as specified in the EDS file:

Assembly:	Assem2	Output
Assembly instance:	102	(0x66)
Connection:	Connection1	Exclusive Owner
Transfer class:	Class 1	

EtherNetIP communication with the 4x50 Ethernet unit also uses a single Assembly consisting of 26 **input** bytes (from the 4x50) as specified in the EDS file:

Assembly:	Assem3	Input
Assembly instance:	103	(0x67)
Connection:	Connection1	Exclusive Owner
Transfer class:	Class 1	

In the following the byte order for the individual parts of the telegrams is LSB 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 4x50 unit) are structured like this:

Lc Register															
Byte 0 (LSB)								**Byte 1 (MSB)**							
7	6	5	4	3	2	1	0	15	14	13	12	11	10	9	8
-	-	-	-	-	-	-	-	-	-	-	-	**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 4x50 unit back to the EtherNetIP master. Once the **AS** in the response coming back from the 4x50 unit matches the **AS** in the request sent to the 4x50 unit, then the EtherNetIP 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 EtherNetIP master must ensure the **AS** response value in the input data (from 4x50) matches the **AS** request value in the output data (to 4x50).

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 4x50 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 be always 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 F – 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 (**SWE**) 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 EtherNetIP 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 4x50 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 *7.6 Appendix F – 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 (**SWE**).

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 4x50 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 *7.6 Appendix F – 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 (**SWE**).

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 4x50 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 *7.6 Appendix F – 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 4x50 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 *7.6 Appendix F – 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 4x50 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 *7.6 Appendix F – 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	0xFFFFFFFD	mg	$*10^{-3}$
-2	0xFFFFFFFE		$*10^{-2}$
-1	0xFFFFFFFF		$*10^{-1}$
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 4x50 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 *7.6 Appendix F – 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 EtherNetIP 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 4x50 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 *7.6 Appendix F – 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 (**EtherNetIP.190129.1v6**), the **SoftwareVersion(X)** will contain:

SoftwareVersion(X)	Contains
SoftwareVersion(0)	190129
SoftwareVersion(1)	1
SoftwareVersion(2)	6

3.2 Data formats

The EtherNetIP 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	0xFFFCF2C0	11111111 11111100 11110010 11000000
-20000	0xFFFFB1E0	11111111 11111111 10110001 11100000
-2000	0xFFFFF830	11111111 11111111 11111000 00110000
-200	0xFFFFFF38	11111111 11111111 11111111 00111000
-2	0xFFFFFFFE	11111111 11111111 11111111 11111110
-1	0xFFFFFFFF	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 Ethernet is determined by SWE.1-2 as follows, where the table shows how a given weight is represented on the Ethernet depending on switch settings:

Weight [gram]	**SWE.1 = OFF SWE.2 = OFF (1 gram)**	**SWE.1 = ON SWE.2 = OFF (1/10 gram)**	**SWE.1 = OFF SWE.2 = ON (1/100 gram)**	**SWE.1 = ON SWE.2 = ON (10 gram)**
1,0	1	10	100	0
123,4	123	1234	123400	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 SWE.3 and SWE.4 as follows:

SWE.4	**SWE.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 Ethernet 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 Ethernet:

SWE.5	**SWE.6**	**SWE.7**	**SWE.8**	**No.**	**Taps**	**Frequency**				**Damping**
						Tavg= 20ms	**Tavg= 100ms**	**Tavg= 200ms**	**Tavg = 400ms**	
OFF	OFF	OFF	OFF	0	-	-	-	-	-	-
ON	OFF	OFF	OFF	1	7	12.0 Hz	2.4 Hz	1.2 Hz	0.6 Hz	-60dB
OFF	ON	OFF	OFF	2	9	10.0 Hz	2.0 Hz	1.0 Hz	0.5 Hz	-60dB
ON	ON	OFF	OFF	3	9	12.0 Hz	2.4 Hz	1.2 Hz	0.6 Hz	-80dB
OFF	OFF	ON	OFF	4	12	8.0 Hz	1.6 Hz	0.8 Hz	0.4 Hz	-60dB
ON	OFF	ON	OFF	5	12	10.0 Hz	2.0 Hz	1.0 Hz	0.5 Hz	-80dB
OFF	ON	ON	OFF	6	15	8.0 Hz	1.6 Hz	0.8 Hz	0.4 Hz	-80dB
ON	ON	ON	OFF	7	17	6.0 Hz	1.2 Hz	0.6 Hz	0.3 Hz	-60dB
OFF	OFF	OFF	ON	8	21	6.0 Hz	1.2 Hz	0.6 Hz	0.3 Hz	-80dB
ON	OFF	OFF	ON	9	25	4.0 Hz	0.8 Hz	0.4 Hz	0.2 Hz	-60dB
OFF	ON	OFF	ON	10	32	4.0 Hz	0.8 Hz	0.4 Hz	0.2 Hz	-80dB
ON	ON	OFF	ON	11	50	2.0 Hz	0.4 Hz	0.2 Hz	0.1 Hz	-60dB
OFF	OFF	ON	ON	12	64	2.0 Hz	0.4 Hz	0.2 Hz	0.1 Hz	-80dB
ON	OFF	ON	ON	13	67	1.5 Hz	0.3 Hz	0.15 Hz	0.075 Hz	-60dB
OFF	ON	ON	ON	14	85	1.5 Hz	0.3 Hz	0.15 Hz	0.075 Hz	-80dB
ON	ON	ON	ON	15	100	1.0 Hz	0.2 Hz	0.10 Hz	0.05 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 EtherNetIP 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:

```
LcZero[x]=LcSignal[x]
```

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

```
LcGross[X] = LcSignal[X] – 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] + …
```

or:

```
Gross = LcGrossCal[X1] + LcGrossCal[X2] + …
```

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:

```
CalFactor = (CalLoad)/(Actual Gross)
```

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

```
GrossCal = CalFactor * 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. Setup IP Address etc. using the EEConnect program as described below.
3. If necessary the EtherNetIP master should be configured to communicate with the 4x50 Ethernet unit using the supplied EDS file.
4. Set the scaling/resolution of the weight signal by use of SWE.1 as described earlier.
5. Set the desired measurement time by use of SWE.3-SWE.4 as described earlier.
6. Select the desired filter by use of SWE.5-SWE.8 as described earlier.
7. The load cells are mounted mechanically and connected to BNC connectors in the front panel of the 4x50 unit.
8. The 4x50 Ethernet unit is connected to the EtherNetIP network using theRS45 Ethernet connector in the front panel.
9. Power (24VDC) is applied at the 2 pole power connectors in the front panel of the 4x50 unit as described in the hardware section, and the EtherNetIP communication is started.
10. Verify that the MS lamp and the NS lamp both end up green.
11. Verify that the TxLC lamp (yellow) is lit (turns on after approx. 5 seconds).
12. Verify that the TxBB lamp (green) are lit (after 10 seconds).
13. Verify that NONE of the 1, 2, 3, 4 or D1 lamps (red) are lit.
14. Verify that the 4x50 Ethernet 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 EtherNetIP master.

6) Hardware Description

6.1 4x50 overview

The following figure is an overview of a 4x50 Ethernet system unit with 4 load cell connections (i.e. a 4450 system unit):

6.2 4x50 front panel description

This chapter describes the connections, DIP-switch settings and lamp indications that are available on the front panel of the 4x50 system unit.

6.2.1 Connection of power

The 4x50 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 4x50 system unit. This powers the entire 4x50 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 4x50 system unit itself **MUST** be placed outside the EX area, and the 4x50 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 4x50 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 RS232 connector (J4)

The small 4 pole connector (J4) at the bottom of the 4x50 Ethernet unit contains an RS232 communication channel. This RS232 channel can be used for setup/configuration of the 4x50 Ethernet unit from a PC. Connection to this connector is made using a special serial cable supplied by Eilersen Electric A/S.

The 4 pole connector (J4) on the 4x50 unit has the following connections:

J4 CONNECTOR	FUNCTION
J4.1	RS232-GND (connected to PC-GND)
J4.2	RS232-RXD (connected to PC-TXD)
J4.3	RS232-TXD (connected to PC-RXD)
J4.4	RS232-GND (connected to PC-GND)

6.2.4 Ethernet connector

The front panel of the 4x50 system unit is equipped with a standard Ethernet RJ47 connector for Cat5 cables.

6.2.5 SW1 settings

The front panel of the 4x50 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**
Sw1.1-Sw1.4	*Reserved for future use*

6.2.6 SWE settings

The front panel of the 4x50 system unit is equipped with an 8 pole DIP switch block named SWE. This DIP switch block has the following function:

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

6.2.7 Light Emitting Diodes (LEDs)

The front panel of the 4x50 system unit is equipped with a number of status lamps (light emitting diodes). These have the following functionality:

LED	FUNCTION
Ethernet connect-or (RJ45) Yellow	**Link** Ethernet is connected.
Ethernet connect-or (RJ45) Green	**Activity** Ethernet data is received or transmitted.
MS (Green/Red)	**Module Status LED** The 4050 Module Status LED, that can be lit/flashing in different colors depending on the status of the module. The function of the MS LED is given in the table below.
NS (Green/Red)	**Network Status LED** The 4050 Network Status LED, that can be lit/flashing in different colors depending on the status of the network. The function of the NS LED is given in the table below.
D1 *(Red)*	*Reserved for future use*
TX	**RS232 TX** RS232 data is transmitted
RX	**RS232 RX** RS232 data is received
TxLC (Yellow)	**4040 communication with load cells** 4040 communication module is communicating with load cells.
TxBB (Right) (Green)	**4040 communication with 4050 Ethernet module (internal)** 4040 communication module is transmitting to 4050 Ethernet 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 MS and NS LED's can in conjunction with the table below be used for error finding.

Light emitting diode	Color	Status	Description
MS	Green	ON	**Normal Operation.** Communication performed normally.
		Flashing	**Standby State.** The unit needs supervision.
	Red	ON	**Unrecoverable fault.** A timer error, memory error or other system error. The unit may need replacing.
		Flashing	**Recoverable fault.** Configuration error, DIP-switch not set correct, IP-Address error or similar error. Correct error and restart unit.
	---	OFF	**No power.** The power is disconnected or the unit is being restarted.
NS	Green	ON	**On-Line, Connection OK.** The unit is On-Line and a connection with the master has been established.
		Flashing	**On-Line, No Connection.** The unit is On-Line but no connection to the master has been established.
	Red	ON	**Critical Communication Error.** The unit has detected an error that makes it impossible to communicate on the network
		Flashing	**Communication Time-Out.** One or more I/O connections are in the Time-Out state.
	---	OFF	**No power/Off-line.** The device may not be powered.

6.3 Hardware Selftest

During power-on the 4x50 ethernet system unit will perform a hardware selftest. The test will cause the light emitting diodes D1, MS and NS to flash shortly one at a time.

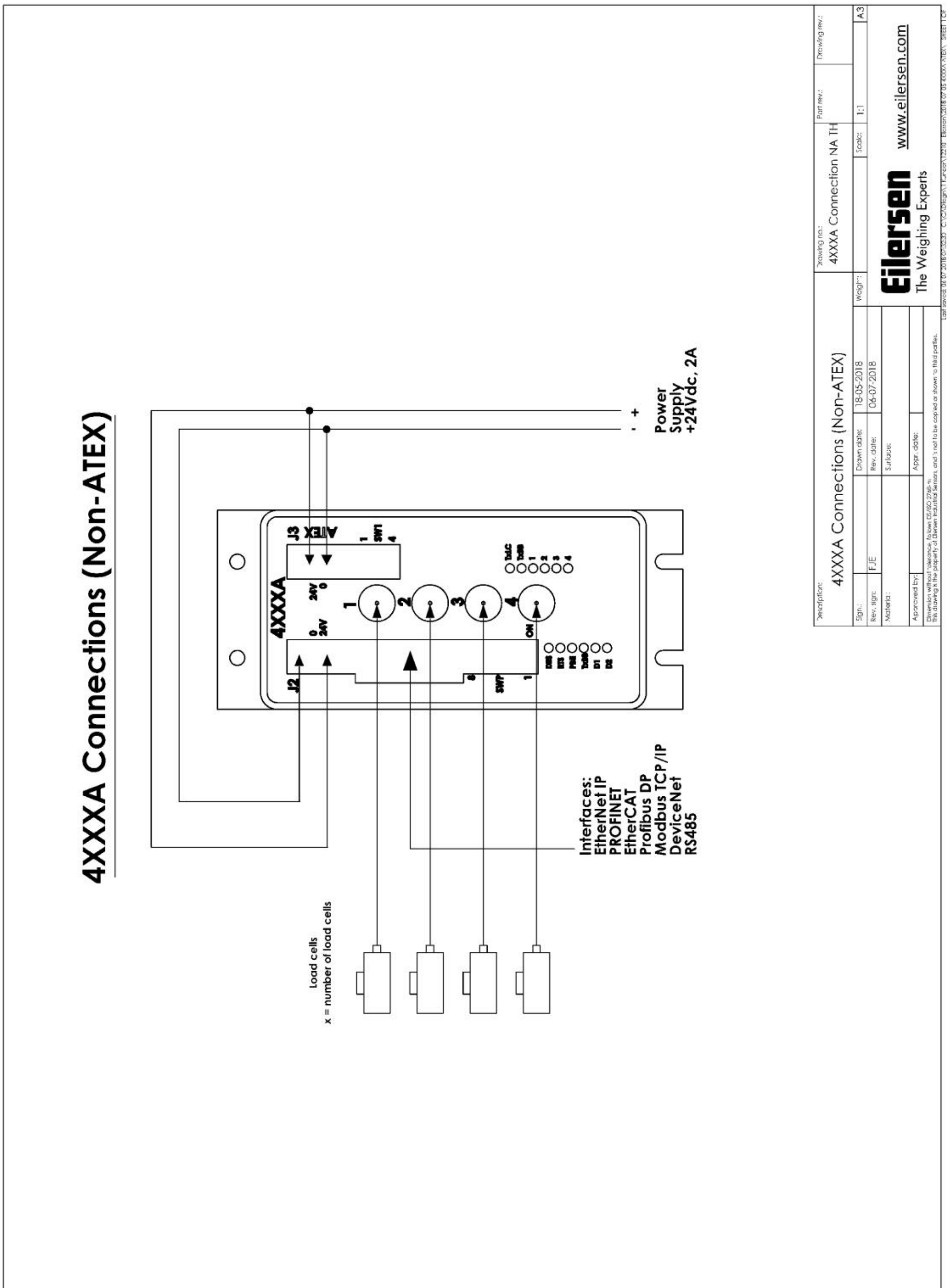
6.4 Update times

The 4x50 Ethernet system unit samples the load cell signals over a period of 20 ms, 100 ms, 200 ms or 400 ms. The hereby found load cell signals are used in the EtherNetIP communication until new signals are achieved when the next sample period expires. Update times across the EtherNetIP communication depends on the specific EtherNetIP configuration (switches, number of units, master scan times etc.) and are beyond the scope of this document.

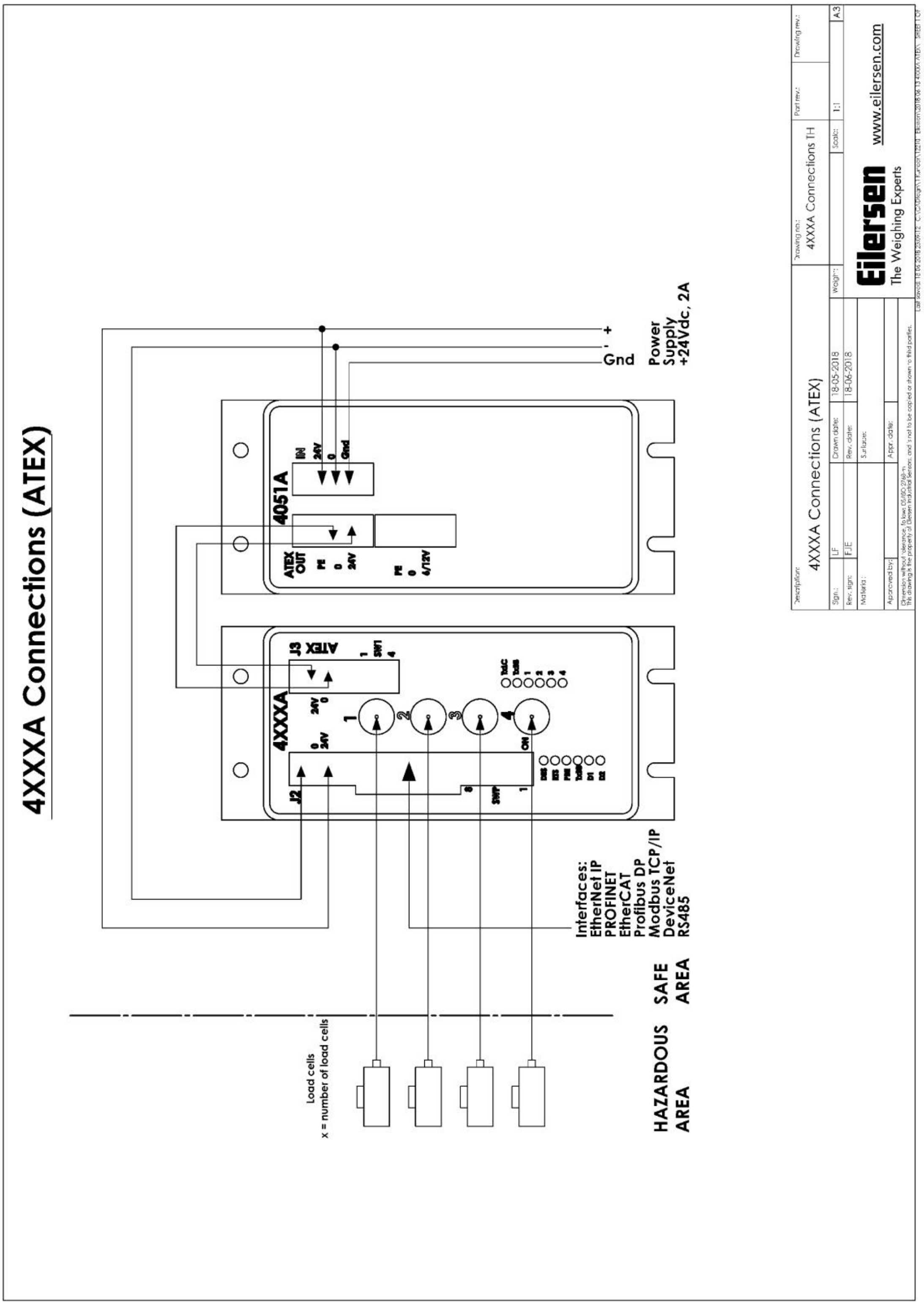
7) Appendices

7.1 Appendix A: Connection of power

7.1.1 Non-ATEX applications



7.1.2 ATEX applications



7.2 Appendix B – Configuration using EEConnect software

It is possible to change the configuration of the 4x50 system unit using the EEConnect software (EEConnect.160305.1v0 or newer), that is supplied by Eilersen Electric A/S. This requires that the 4x50 unit is connected directly to a PC using Ethernet as described in the users guide to the EEConnect software.

7.2.1 Change of IP Address, SubNet mask etc.

The MAC address of the 4x50 unit is preset to a unique value within the Eilersen Electric A/S range. The default settings for IP address, SubNet mask etc. are:

DHCP:	Disabled
IP Address:	192.168.1.199
Subnet mask:	255.255.255.0

It is possible to change these values using the EEConnect software. The procedure for changing these parameters is described in the EEConnect users guide.

7.2.2 Download of new software

It is possible to download new software to the 4x50 Ethernet unit using the EEConnect software. The procedure for download of new software is described in the EEConnect users guide.

7.3 Appendix C – Allen Bradley connection

To connect the module to an Allen Bradley (Rockwell Automation) PLC using the Logix 5000 software the following must be observed:

1. Use the "ETHERNET MODULE Generic Ethernet Module
2. Set connection format to "SINT"
3. Set "Input" "Assembly instance to 103, "Size" 26 (8-bit)
4. Set "Output" "Assembly instance to 102, "Size" 2 (8-bit)
5. Set "Configuration" "Assembly instance to 101, "Size" 1 (8-bit)

7.4 Appendix D – Omron connection

The supplied EDS file can be used in the Omron configurator.

But please beware that the terms "input" and "output" may be confusing in the Omron configurator. These terms are always from the PLC's point of view. So the data from the 4x50 module to the PLC is referred to as "input" even though it is actually an output from the 4x50.

The input data from the 4x50 module is found in the input assembly 103.

The output data to the 4x50 module is found in the output assembly 102.

The configuration assembly (101) is not used.

7.5 Appendix E – Internal Features

7.5.1 4050 Ethernet module

This chapter describes possible connections, DIP-switch settings and jumper settings that are available internally on the 4050 Ethernet module. These will normally be set from Eilersen Electric and should only be changed in special situations.

7.5.2 SW2 settings

The 4050 Ethernet module is internally equipped with an 8 pole DIP switch block named SW2. This DIP switch block has the following function:

SWITCH	**FUNCTION**
Sw2.1-Sw2.8	*Reserved for future use*

7.5.3 Light Emitting Diodes (LEDs)

The 4050 Ethernet module is internally equipped with 4 LEDs. These LEDs have the following functionality:

SWITCH	**FUNCTION**
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 (Red)	**Power** 3.3 VDC internal power supply is on.

7.5.4 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, please refer to the separate documentation that describes the 4040 communication module and its specific software.

7.5.5 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*

7.5.6 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)

7.5.7 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**
D11 *(Red)*	*Reserved for future use*
D12 *(Red)*	*Reserved for future use*
D13 *(Red)*	*Reserved for future use*
D14 *(Red)*	*Reserved for future use*

7.6 Appendix F – 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	*Reserved for future use*
0002	*Reserved for future use*
0004	*Reserved for future use*
0008	*Reserved for future use*
0010	*Reserved for future use*
0020	*Reserved for future use*
0040	*Reserved for future use*
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 4050 module? Bad setting of DIP switches on 4040 communication module?
0100	*Reserved for future use*
0200	*Reserved for future use*
0400	*Reserved for future use*
0800	**No load cell answer** Bad connection between 4040 communication module and 4050 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	*Reserved for future use*
4000	*Reserved for future use*
8000	*Reserved for future use*

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