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# 2x50 ETHERNET MODULE

**Status and weight transfer using EtherNetIP**

Applies for:
Program no.: ETHERNETIP.121113.2v0
Document no.: 1113mu2x50-2v0
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# 1) Contents

# 2) Introduction

## 2.1 Introduction

This document describes the use of a 2x50 Ethernet module from Eilersen Electric, when it is equipped with the program listed on the front page.

With the program specified on the front page, the 2x50 Ethernet module is capable of transmitting weight and status for up to 6 loadcells in a single telegram. Each loadcell is connected to the Ethernet module through a loadcell interface module.

It is possible to connect the 2x50 Ethernet module 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 loadcells. Functions as zeroing, calibration and calculation of system weight(s) must be implemented **outside** the 2x50 in the EtherNetIP master.

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

## 2.2 EtherNetIP specification

The 2x50 EtherNet module 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 |

## 2.3 ATEX (Ex) specification

**IMPORTANT: Load cell modules and instrumentation 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 EtherNetIP communication

Ethernet communication with the 2x50 Ethernet module uses a single Assembly consisting of 38 bytes data as specified in the EDS file:

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

The data bytes are structured like this:

| **Lc Register** | | **Lc Status(0)** | | **Lc Signal(0)** | | | | | **Lc Status(5)** | | **Lc Signal(5)** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | 32 | 33 | 34 | 35 | 36 | 37 |

The byte order for the individual parts of the telegram is LSB first. In the following bit 0 will represent the least significant bit in a register.

**LcRegister** is a word (two bytes) that constitute a bit register for indication of connected loadcells detected during power on. Hence bit 0-5 will be ON, if the corresponding loadcell (address) was detected during power on. **LcRegister** is always transferred in **16 bit unsigned integer** format.

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 loadcell **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 the chapter *STATUS CODES*.

**LcSignal(X)** is a double word (four bytes) constituting a register containing the actual weight signal from loadcell **X** in **32 bit signed integer** format. Note that the value is only valid if the corresponding **LcStatus(X)** register is 0 indicating no error present. The resolution of the loadcell signal is selectable. Please see below.

Since only status and weight for the loadcells 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 *Data Processing* for an explanation on how this typically can be done.

## 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.

## 3.3 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 |

## 3.4 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 |

### 3.5 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 SW1.1-2 as follows, where the table shows how a given weight is represented on the Ethernet depending on switch settings:

| **Weight [gram]** | **SW1.1 = OFF SW1.2 = OFF (1 gram)** | **SW1.1 = ON SW1.2 = OFF (1/10 gram)** | **SW1.1 = OFF SW1.2 = ON (1/100 gram)** | **SW1.1 = ON SW1.2 = ON (10 gram)** |
|---|---|---|---|---|
| 1,0 | 1 | 10 | 100 | 0 |
| 123,4 | 123 | 1234 | 12340 | 12 |
| 12341 | 12341 | 123410 | 1234100 | 1234 |

### 3.6 Measurement time

By use of a DIP-switch it is possible to choose between two different measurement times. All loadcells are sampled/averaged over a measurement period determined by SW1.3 as follows:

| **SW1.3** | **Measurement time** |
|---|---|
| OFF | 200 ms |
| ON | 20 ms |

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

## 3.7 Filtering

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

| SW1.4 | SW1.5 | SW1.6 | SW1.6 | 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 loadcells belonging to the system. This is explained below. **Note** that the result is only valid if all status registers for the loadcells in question indicate <u>no</u> errors. It should also be noted that it is up to the master to ensure the usage of consistent loadcell 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 loadcells in the specific system) should be performed as follows, taking into account that no loadcell errors may be present during the zeroing procedure:

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

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

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

```
LcGross[X] = LcSignal[X] - LcZero[X]
```

## 4.2 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 loadcell that is to be corner calibrated.
3) Calculate the corner calibration factor that should be multiplied on the uncalibrated gross weight of the loadcell 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 loadcell as follows:

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

## 4.3 Calculation of uncalibrated system weight

Based on the loadcell 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] + …
```

## 4.4 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. **NOTE:** In order to achieve a correct calibration of the system it is recommended, that the used calibration load is at least 50% of the system capacity.
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 loadcell under each supporting point. For example on a three legged tank with only one loadcell, 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 2x50 Ethernet module using the supplied EDS file.
4. Set the scaling/resolution of the weight signal by use of SW1.1-2 as described above.
5. The loadcells are mounted mechanically and connected to the 2x50 Ethernet module using their corresponding loadcell interface module. The loadcell addresses are set using the DIP-switches on the loadcell interface modules, so that they forth running from address 0 (0-5).
6. The 2x50 Ethernet module is connected to the EtherNetIP network using the RS45 Ethernet connector in the front panel.
7. Power (24VDC) is applied through the two pole connector (J2). The EtherNetIP communication is started.
8. Verify that the **MS** lamp and the **NS** lamp both end up green .
9. Verify that the **TxBB** lamp (green) on the Ethernet module is lit (after 10 seconds), and that the **TxBB** lamps on all the loadcell interface modules are also lit (can flash slightly).
10. Verify that none of the **D1** or **D2** lamps are lit.
11. Verify that the 2x50 Ethernet module has found the correct loadcells (**LcRegister**), and that no loadcell errors are indicated (**LcStatus(x)**).
12. Verify that every loadcell gives a signal (**LcSignal(x)**) by placing a load directly above each loadcell one after the other (possibly with a known load).

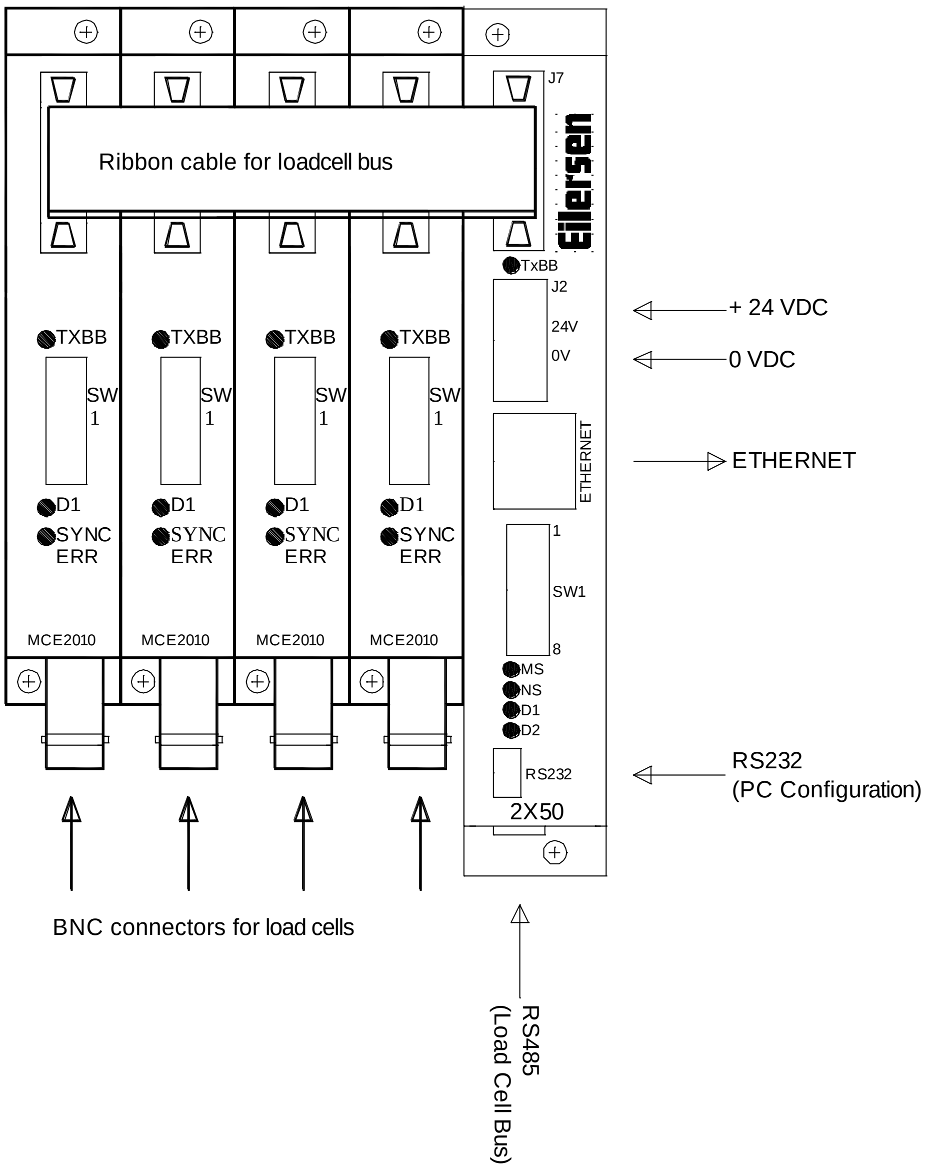
The system is now installed and a zero and fine calibration is made as described earlier. Finally verify that the weighing system(s) returns a value corresponding to a known actual load.

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 2x50 overview

The following figure is an overview of how a 2x50 Ethernet system is made using four loadcell interface modules:



## 6.2 Connection of power (J2)

This chapter describes the connection of power supply to the 2x50 Ethernet module.

The 2x50 module is powered by applying +24VDC on the green two pole connector (J2) as specified on the front panel of the 2x50 module. This powers the entire 2x50 system including the loadcell interface modules and loadcells connected using the supplied ribbon cable described below.

The 2 pole connector (J2) on the 2x50 Ethernet module has these connections:

| J2 CONNECTER | FUNCTION |
|---|---|
| J2.1 | +24VDC (Vin) |
| J2.2 | 0 VDC (GNDin) |

**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.

## 6.3 Connection of loadcells (J7)

This chapter describes the connection of loadcells to the 2x50 Ethernet module.

The 10 pole connector (J7) on the 2x50 module is connected to the 10 pole connectors on the loadcell interface modules using the supplied ribbon cable with mounted connectors. Through this RS485 bus cable connection of power supply to the individual modules is achieved and data can be transferred from the loadcell modules to the 2x50 module.

The 10 pole connector (J7) on the 2x50 Ethernet module has these connections:

| J7 CONNECTER | FUNCTION |
|---|---|
| J7.1 – J7.2 | RS485-B (DATA- ) |
| J7.3 – J7.4 | RS485-A (DATA+) |
| J7.5 – J7.6 | 0 VDC (GNDin) |
| J7.7 – J7.8 | +24VDC (Vin) |
| J7.9 – J7.10 | I/O line |

### 6.4 RS485 connector (J1)

The green 3 pole connector (J1) at the bottom of the 2x50 Ethernet module contains the same RS485 bus that is available through the ribbon cable connector (J7), which is normally used for interfacing loadcells. This allows an alternate way of connecting loadcells to the 2x50 module. In other applications where no loadcells are connected to the 2x50 module, this connector may be used to interface different equipment to the 2x50 module using RS485 communication.

The 3 pole connector (J1) on the 2x50 Ethernet module has these connections:

| J1 CONNECTER | FUNCTION |
|---|---|
| J1.1 | RS485-B (DATA- ) |
| J1.2 | RS485-A (DATA+) |
| J1.3 | 0 VDC (GNDin) |

### 6.5 RS232 connector (J4)

The small 4 pole connector (J4) at the bottom of the 2x50 Ethernet module contains an RS232 communication channel. This RS232 channel can be used for setup/configuration of the 2x50 Ethernet module 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 2x50 module 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) |

### 6.6 Ethernet connector (J8)

The front panel of the 2x50 Ethernet module is equipped with a standard Ethernet RJ47 connector for Cat5 cables.

## 6.7 DIP-switch settings

The 2x50 Ethernet module is equipped with an 8 pole DIP switch block located in the front of the module named SW1. This DIP switch block has the following function:

| **SWITCH** | **FUNCTION** |
|---|---|
| SW1.1-2 | **Scaling** Used to select the desired scaling as described above. |
| SW1.3 | **Measurement time** Used to select the desired measurement time as described above. |
| SW1.4-SW1.7 | **Filtering** Used to select the desired filter as described above. |
| *SW1.8* | *Reserved for future use* |

The 2x50 Ethernet module is also equipped with an 8 pole DIP switch block located inside the module that is only accessible if the cover is removed. This DIP switch block is named SW2 and has the following function:

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

## 6.8 Light Emitting Diodes (LEDs)

The 2x50 Ethernet module is equipped with a number of status lamps (LEDs) located in the front panel. These have the following functionality:

| **LED** | **FUNCTION** |
|---|---|
| TxBB (Green) | **2x50 communication with loadcells** Ethernet module is communicating with loadcells. |
| Ethernet connector (RJ45) Yellow | **Link** Ethernet is connected. |
| Ethernet connector (RJ45) Green | **Activity** Ethernet data is received or transmitted. |
| MS (Green/Red) | **Module Status LED** The 2x50 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 2x50 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* |
| *D2 (Red)* | *Reserved for future use* |

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 module needs supervision. |
| | Red | ON | **Unrecoverable fault.** A timer error, memory error or other system error. The module may need replacing. |
| | | Flashing | **Recoverable fault.** Configuration error, DIP-switch not set correct, IP-Address error or similar error. Correct error and restart module. |
| | --- | OFF | **No power.** The power is disconnected or the module is being restarted. |
| NS | Green | ON | **On-Line, Connection OK.** The module is On-Line and a connection with the master has been established. |
| | | Flashing | **On-Line, No Connection.** The module is On-Line but no connection to the master has been established. |
| | Red | ON | **Critical Communication Error.** The module 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. |

The 2x50 Ethernet module is also equipped with a number of status lamps (LEDs) located inside the module and are only visible if the cover is removed. These have the following functionality:

| SWITCH | FUNCTION |
|---|---|
| D4<br>(Yellow) | **RS485 RX**<br>RS485 data is received. |
| D9<br>(Green) | **RS485 TX**<br>RS485 data is transmitted. |
| D14<br>(Yellow) | **RS232 RX**<br>RS232 data is received. |
| D5<br>(Green) | **RS232 TX**<br>RS232 data is transmitted. |
| D10<br>(Red) | **Power**<br>3.3 VDC internal power supply is on. |

## 6.9 Hardware Selftest

During power-on the 2x50 Ethernet module will perform a hardware selftest. The test will cause the light emitting diodes D2, MS and NS to flash shortly one at a time.

## 6.10 Update times

The 2x50 Ethernet module samples the loadcell signals over a period of 200 mS. The hereby found loadcell 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 – Status Codes

Status codes 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 | **Invalid/missing 'sample' ID**<br>Bad connection between communication module and loadcell module. |
| 0002 | **Loadcell timeout**<br>Check that the loadcell is connected to the loadcell module. |
| 0004 | **Loadcell not synchronized**<br>Bad connection between loadcell and loadcell module. |
| 0008 | **Hardware synchronization error**<br>Cable between loadcell modules shorted or disconnected. |
| 0010 | **Power failure**<br>Supply voltage to loadcells is to low. |
| 0020 | **Overflow in weight calculation**<br>Internal error in loadcell module. |
| 0040 | **Invalid/missing 'latch' ID**<br>Bad connection between communication module and loadcell module. |
| 0080 | **No answer from loadcell module**<br>No data is received from this loadcell module. This can be caused by the removal of the loadcell module, no power to the module or that the connection between loadcell module and communication module is broken. |
| *0100* | *Reserved for future use* |
| *0200* | *Reserved for future use* |
| *0400* | *Reserved for future use* |
| 0800 | **No loadcell modules answer**<br>Bad connection between communication module and loadcell module. Not all telegrams from communication module are received in loadcell module. |
| *1000* | *Reserved for future use* |
| *2000* | *Reserved for future use* |
| *4000* | *Reserved for future use* |
| *8000* | *Reserved for future use* |

## 7.2 Appendix B – Configuration using EEConnect software

It is possible to change the configuration of the 2x50 module using the EE-Connect software (EEConnect.160305.1v0 or newer), that is supplied by Eilersen Electric A/S. This requires that the 2x50 module 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 module 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 2x50 Ethernet module 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" 38 (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 2X50 module to the PLC is referred to as "input" even though it is actually an output from the 2X50.

The data from the 2X50 module is found the input assembly 103.

The output and the confirmation assemblies (101 and 102) are not used.