Operation Manual

OPW Fluid Transfer Group Europe B.V.

Rack Monitor 8800E/8801E

Version *A.7*
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OPW® Fluid Transfer Group Europe B.V. A DOVER COMPANY

civacon™

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Disclaimer

In this document an operation manual is presented of the **OPW** Rack Monitor 8800E/8801E. It is important that the end user (in many cases the operator) of the **OPW** Rack Monitor 8800E/8801E has an adult age, is skilled, reads and understands this manual, otherwise it is not recommended to use the **OPW** Rack Monitor 8800E/8801E.

OPW Fluid Transfer Group Europe BV guarantees that this product is adequate for the stated use and is in accordance with the Directive(s) stated in the declaration of conformity in this manual.

OPW Fluid Transfer Group Europe BV can not be held responsible for incorrect use of the RACK MONITOR 8800E/8801E. The Rack Monitor 8800E/8801E is for the use of monitoring of loading of tank trucks with the application and parameters stated in this manual.
In case this OPW Rack Monitor 8800E/8801E is used in another location than mentioned in the initial quotation or is abused, all guarantees will be declined.

This operation manual is a part of the supplied product and must at all times accompany the Rack Monitor 8800E/8801E, when it is relocated or sold to a third party. All pages of this manual should be present, in accordance to the table of contents. If not, please contact the **OPW Fluid Transfer Group Europe BV**.

This is an **OPW Fluid Transfer Group Europe BV** product, for technical assistance, information and/or complaints contact:

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Mr. Harry Gilde
Managing Director

Warranty

All parts and products are thoroughly inspected and tested from the time raw material is received at our plant, until the product is completed. We guarantee that all products are free from defects in materials and workmanship for a period of one year from the date of shipment. Any product that may prove defective within said one year period will, at our option, be promptly repaired, or replaced, or credit given for future orders. This warranty shall not apply to any product which has been altered in any way, which has been repaired by any party other than an authorized service representative, or when such a failure is due to misuse or conditions of use. We shall have no liability for labor costs, freight costs, or any other cost or charges in excess of the amount of invoice for the products.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, AND SPECIFICALLY THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Approvals

The 8800E/8801E CIVACON Loading Rack Monitor is suitable for
Equipment group II, category 2(1)
Class I, Division 1, Groups C & D
hazardous locations with intrinsically safe outputs, and housed in an Explosion Proof Enclosure. All monitors are ATEX / FM / CSA approved. Please consult the factory for the availability of special models.

Technical assistance in the U.S.A.

If at any time during the installation a question arises that is not covered in this Installation Instruction, or with any other applicable documents referenced, feel free to call the CIVACON ELECTRONICS TECHNICAL ASSISTANCE LINE :

In the U.S.A., Call 1-800-5 CIVACON . (800-524-8226)

For the CUSTOMER SERVICE DEPARTMENT :

In the U.S.A., Call 1-888-526-5657
In other countries, call your local agent.

4304 MATTOX RD. * KANSAS CITY, MO 64150
PH: (816) 741-6600 * FAX: (816) 741-1061
(888) 526-5657 (888) 634-1433

EC Declaration of Conformity

In accordance with ISO/IEC 17050:2004

No. DOC07001

We ***OPW Fluid Transfer Group Europe BV***

of Roggestraat 38
2153 GC Nieuw Vennep
The Netherlands
T: +31 (0)252 660 300

declare that:

Product description	: Rack Monitor 8800E/8801E
Item number	: 8800E/8801E
Serial no./ Lot no.	: see Installation manual
Brand name	: Civacon
Protection Type	: EEx d IIB T4
Certificate number	: Zelm 07 ATEX 0332 X
Product category	: II 2 G

is/are in accordance with the following Directives:

94/9/EC	***ATEX 95 – Explosion Safety Directive*** and its amending directives
2004/108/EC	***EMC – Electro Magnetic Compatibility Directive*** and its amending directives

has been designed and manufactured to the following specifications:

EN 60079-0	*Electrical apparatus for explosive gas atmospheres – Part 0: General requirements*
EN 60079-11	*Electrical apparatus for explosive gas atmospheres – Part 11: Intrinsic safety "i"*
EN 60079-1	*Electrical apparatus for explosive gas atmospheres – Part 1: Flameproof enclosures "d"*
EN 61000-6-2	*Generic standards, Immunity for industrial environments*
EN 61000-6-4	*Generic standards, Emission for industrial environments*

I hereby declare that the equipment named above has been designed to comply with the relevant sections of the above referenced specifications. The unit complies with all essential requirements of the Directives.

The commitments are fulfilled towards: ***Zelm Ex***
Siekgraben 56, 38124 Braunschweig, Deutschland
Identification number: ***CE 0820***

Place : Nieuw Vennep Date :

There is a signed declaration of conformity in the installation manual.

Mr. Harry Gilde
Managing Director

(Authorized signatory on behalf of OPW Fluid Transfer Group Europe B.V.)

Table of Contents

Specifications

The Rack Monitor 8800E/8801E is a loading rack monitoring system, detects and communicates an overfill condition to the loading rack control automation equipment by means of a normally open relay contact. In addition this non-permissive condition as well as diagnostic information is displayed. A typical system contains loading rack control monitor (88xxE Rack Monitor) and a API 10 wire screened coiled cable with a black 10 pins 4 J-slot plug (Model 7400E).

Thermistor and optic signal inputs allow compatibility with the NEN-EN13922 and two other API standard signalling conventions commonly used in the industry. Either of these signals comes from the truck/trailer mounted onboard control monitor or sensors. The 88xxE rack monitor supersedes the 84xx and 85xx type rack monitors and are suitable for hazardous locations with intrinsically safe outputs.
There are two versions available. The Rack Monitor 8800E is a complete version with liquid crystal display. And the Rack Monitor 8801E version without a liquid crystal display.
The installation of both versions is the same.

Electrical Specifications

Mains:

Nominal min. input voltage : 90 Vac.
Nominal max. input voltage : 250 Vac.
Nominal input current : 0,4 A_{RMS} @ 110 Vac
Nominal input current : 0,2 A_{RMS} @ 230 Vac
Frequency : 50 / 60 Hz

The nominal power consumption depends on ambient temperature.
Above -10ºC (14ºF) no internal heating is needed

Nominal power consumption : 20VA.

Below -10ºC (14ºF) a certain amount of power is used to keep the liquid display within operating temperature.

Version 8800E
Nominal power consumption : 30VA.
Version 8801E
Nominal power consumption : 20VA.

Mains current limitation
internal fuses : 2AT

Inputs.

Sensor	Terminal CN2 Pin 1~ 8 : all EN13922 compliant sensors. : all industry standard format overfill detection sensors . Two-Wire sensor (maximum eight) . Two-Wire Thermistor sensors (maximum eight) . Five-Wire sensors (maximum twelve) . ROM 3204E Onboard monitor. : Dry sensor emulator (dummy)
Ground verification	Terminal CN2 Pin 9 : verification according EN13922 : Positive and negative sensing
Truck comms	Terminal CN2 Pin 11 :Tank truck data communication prepared
Emergency switch	: an intrinsically safe normally closed input. (latched or un-latched.)

Outputs.

Permit Relay output

Voltage	: 250V ac/dc
Current limitations	: 5AT Internal Fuses
Functional specs	: Form-A, Normally open safety relay contacts **energized when rack monitor overfill circuit is permissive**

Ground verification Relay output

Voltage	: 250V ac/dc
Current limitations	: 5AT Internal Fuses
Functional specs	: Form-A, Normally open relay contacts energized when Ground connection is verified

Auxiliary 1 Relay output

Voltage	: 250V ac/dc
Current limitations	: 5AT Internal Fuses
Functional specs	: Form-C (SPCO) Auxiliary relay See label inside box for functionality

Auxiliary 2 Relay output

Voltage	: 250V ac/dc
Current limitations	: 5AT Internal Fuses
Functional specs	: Form-C (SPCO) Auxiliary relay See label inside box for functionality

Communications.

RS485/422	: galvanic isolated data communication port (non IS) : Half duplex (RS485) : Full duplex (RS422) : multi-drop : standard 9600Bps ,8 Bits 1Stopb No parity : selectable 120Ω terminator. : rotary switch selectable Monitor address 00~99 See label inside box for addition dipswitch setting.
Ethernet interface	:Industry standard 4 wire RJ45 connector Contact OPW FTG for availability.

Miscellaneous.

Optional socket	: expansion slot for additional functionality.
Real Time Clock	: precise trimmed Quartz real time clock. : clock is set to Greenwich Mean Time (GMT)
SD Ram socket	: Primary used for Update Firmware : Secondary used for Time stamped data / event logging.

External environment reminder *(see installation manual for details)*

Operating Temperature Range (T_a)	: -45°C (-42.8°F) to +70°C (158°F)
Storage Temperature 8800E (T_s)	: -20°C (-4°F) to +70°C (158°F)
Storage Temperature 8801E (T_s)	: -45°C (-42.8°F) to +70°C (158°F)

The storage and transport ambient temperature of the 8800E may never exceed the above mentioned temperature range to prevent damage to the liquid crystal display.
The 8801E Rack monitor can be stored at Operating Temperature

Read installation chapter for recommended precautions when the 8800E/8801E is used in the maximum ambient operating temperature range.

The Liquid crystal display must be shielded from direct sunlight.

View angle display	: ~25°
Visibility display	: ~0.5 m
View angle LED's	: 120°
Visibility LED's	: 20 m (no direct sunlight)

Main Seal : certified Silicon label. Use only OPW part H71197 as replacement.

- The gasket(s) is attached or secured to bottom part to prevent loss, damage or incorrect assembly. The gasket material shall not itself adhere to the other joint face and has to be slightly greased.

Product Description.

This manual describes the operation, and troubleshooting of the Civacon 8800E/8801E Loading Rack Monitoring System.
Read separate installation manual for wiring the rack monitor
It is intended to help operators, maintenance persons, and equipment specifiers understand the operation and standard features of the 8800E/8801E Rack monitor
It is recommended reading this manual before installation of the equipment.
The 8800E/8801E monitor is a loading rack monitoring system designed to offer a reliable and safe assistance when loading a tank truck.
It can detect and work with a wide variety of overfill sensors but can also be set to accept only sensors conform.

EN13922 Tanks for transport of dangerous goods
Service equipment for tanks
Overfill prevention systems for liquid fuels

The 8800E monitor is designed to interface with the user by means of a large multi languages Liquid Crystal Display and Light Emitting Diodes indicators (LED)
A clear and short message will be shown on the Liquid Crystal Display to explain the status of the overfill sensors, cabling and Rack monitor.
The 8801E monitor is designed to be used where environment does not meet the necessary temperature specifications when the monitor is switched off.

Note: For simplicity the manual will refer to the standard 8800E Rack monitor with Liquid Crystal Display. and therefore all information mentioned as shown on the LC-Display must be ignored when a 8801E is used.

Both 8800E and 8801E are standard equipped with a high quality blue cord set and a black 10 pins plug. An junction box (Model 7500 Series) can be ordered as an option. Passive (and active) storage plug hangers are also available.
Please consult the factory for the current availability of all optional products. Thermistor and Optic signal inputs allow compatibility with the European standard EN13922 as well as the two API standard signalling conventions commonly used in the industry. Either of these signals comes from the truck/trailer mounted onboard control monitor or sensors.

Front layout.

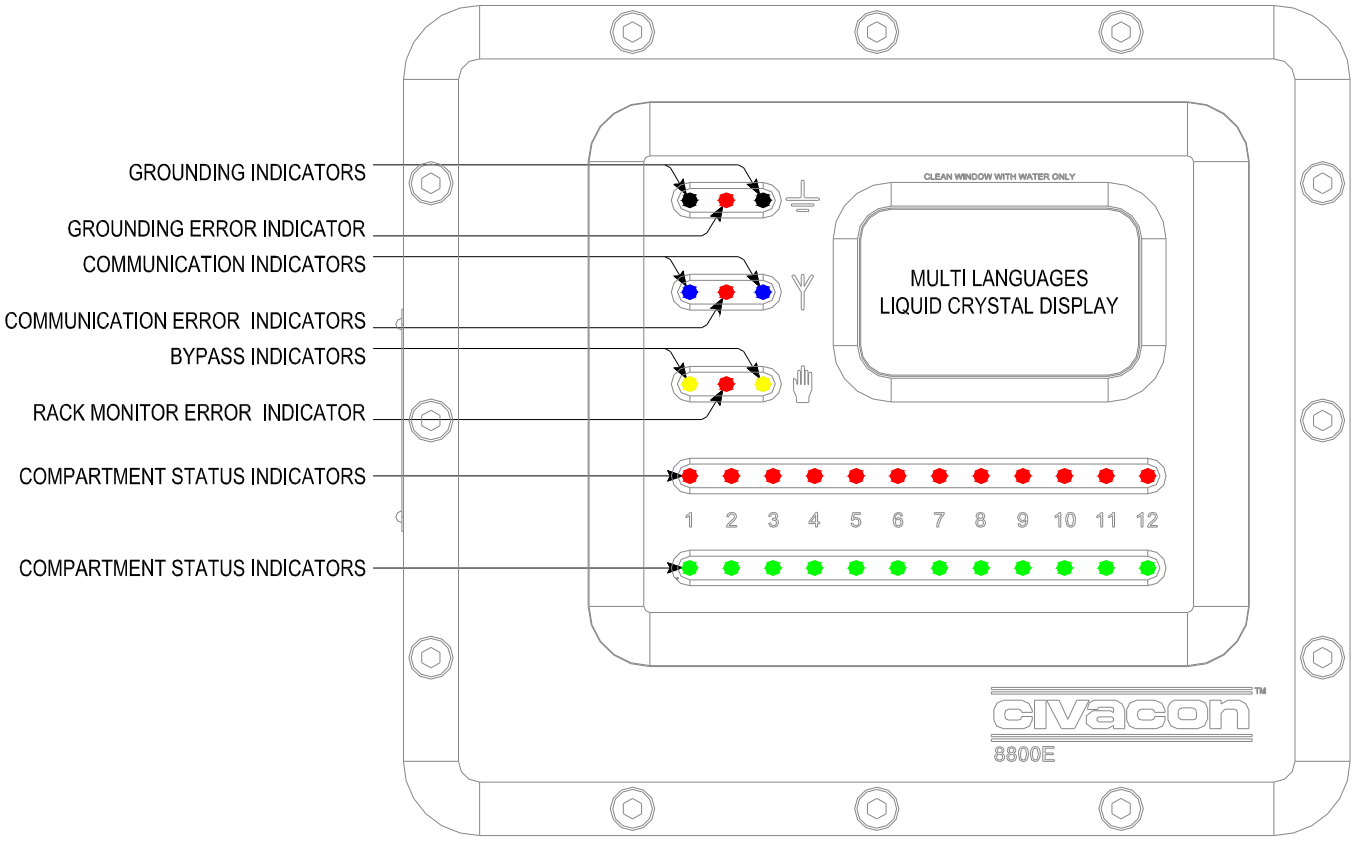


Figure 1

Besides the large multi languages Liquid Crystal Display five Indicator bars are used to interface with the user.

- The upper bar is indicating the status of the ground verification.
- Second bar is indicating the internal communication of the electronics.
- The Yellow indicators on the third bar are flashing if a bypass is activated.
  The Red indicator will flash if a internal system error is detected.
- The remaining Red bar and Green bar are indicating the status of the sensors.

LED (electronic light indicator) Display info at power up.

LED Test sequence.
During power up the Red Error indicator in the middle small bar will start flashing every ½ second to indicate no communication is present.
When the main processor starts sending messages to the LED and LC-Display board the two Blue indicators will start flashing inversely and the Red indicator will be switched off.

1. Middle Red — Communication error indicator
2. Two Blue — Communication indicator (flashing)

The LED test sequence will continue with:

3. Left White — Grounding indicator
4. Right White — Grounding indicator
5. Middle Red — Grounding error indicator
6. Left Yellow — Bypass indicator
7. Right Yellow — Bypass indicator
8. Middle Red — System error indicator
9. Red bar — Compartment 1 till 12 indicators
10. Green bar — Compartment 1 till 12 indicators

All indicators have been switched on and off and the LED display is ready to receive sensor data from the main controller.

When no truck is connected all Red compartment indicators shall be on and a message will appear on the LC-Display. The two blue communication indicators will flash inversely to indicate proper internal communication.
As soon as the plug is connected to a truck an extensive short and open circuitry test will be preformed and valid ground verification will be shown by two inversely flashing white indicators (see Figure 1).
After the auto switching mechanism has detected type and amount of sensors the indication of the Red and Green LED indicator compartment bar will lit up accordingly.

LED Display info.

Two-Wire sensors

Getting permissive,
(connect Plug)
Red compartment indicators are continuous on.
White earth indicators inversely flashing (if ok).
Green indicators flashing : getting permissive (e.g. heating).
Green indicators continuous on : compartment dry

If all (8) green indicators are continuous on (DRY) the red indicators will be switched off and truck is permissive to load.

Getting wet during loading.
Green indicators : of all dry compartments are continuous on and wet compartment is off
Red indicator : of all dry compartment are flashing and wet compartment is continuous on.

If bypass key is used.
Green indicators : of all dry compartments are continuous on and wet compartment is off
Red indicator : of all dry compartments are off and wet compartment continuous on
Yellow indicators : inversely flashing
Continuous checking overfill detection on non-bypassed compartments.

Getting wet again during loading.
Green indicators : of all dry compartments are continuous on and wet compartments are off
Red indicator : of all dry compartment are flashing and wet compartments are continuous on.
Yellow indicators : inversely flashing

Five-Wire sensors

Getting permissive,
(Connect Plug)
Red compartment indicators are continuous on.
White earth indicators inversely flashing (if ok).
Green indicators : amount of dry detected compartments
the red indicators will be switched off and truck is permissive to load.

Getting wet during loading. (e.g. 6 compartment truck. 4 becomes wet)
Green indicators : dry compartments 1,2,3 and 5 are continuous on and wet compartment 4 is off
Red indicators : dry compartments 1,2,3 and 5 till 12 are flashing and wet compartment 4 is continuous on.

If bypass key is used.
The Rack Monitor will switch to permissive but no compartments will be monitored due to sensor characteristics.
Yellow indicators : inversely flashing

Getting wet again during loading.
No continuous overfill detection possible in Five-Wire mode.

Faulty detected sensors.
LED indication when a sensor fault (or more) is (are) detected
Green indicators : all off
Red indicator : all correct detected sensors are flashing and faulty sensor(s) is (are) continuous on
If the fault is bypassed the rack monitor will revert to the state mentioned above with the faulty channels bypassed.
Note: is some, cases most likely with Five-Wire sensors it is not possible to continue with an overfill detection functionality.

Sensors Types.

Two-Wire Thermistor Sensors. (NTC)
Two-Wire sensors.
Five-Wire sensors.

Sensors and Grounding.

Before continuing describing the functionality of the rack monitor a short explanation of the sensors and ground verification.
As mentioned above there are three industrial standard sensor principals.
There are two industrial standards for the Two-Wire sensors.
A Thermistor sensor with a negative temperature coefficient (NTC) and a Two-Wire optic or compatible sensor. The Thermistor sensor is basically a heating element in combination with a temperature sensor.
The Thermistor sensors are heated up to approximately 75°C (167°F) (Depending type).
Time to heat the sensor depends on ambient temperature and used Thermistor type.
(how the 8800E will handle the Thermistor is explained later in this document).
The sensing circuit of a 2 (and 5) wire sensor are not necessarily done with a optic detection circuit. To avoid misunderstanding this manual will refer to Two-Wire sensors and Five-Wire Sensors. Two-Wire sensors can be used on vehicles with no more then eight compartments. Standard Rack monitors are monitoring all 8 channels (see Dipswitch setting for 6 channels US version). This means remaining channel(s) on vehicles equipped with Two-Wire sensors with less then 8 compartments must be connected to a electronic Dummy (e.g. part number 1920). All sensors are individual Wired / connected to the Rack monitor and more than one wet compartment can be detected at the same time.

The Five-Wire sensors are connected in series and therefore capable of handling more then 8 compartments. Because of this, only one wet compartment can be detected at the same time. A special diagnostic wire is used to determine the wet compartment. The 8800E can handle more then 12 compartments but only 12 will can be indicated on the LED display.
(Maximum 12 compartments according EN13922)
The 8800E will try to determine which compartment is wet if more than 12 compartments are used and if a good connection is made between plug and socket and wiring are done carefully, the 8800E shall indicate the correct compartment on the Liquid Crystal Display.

Note: Displaying the correct wet compartment is only possible if there are no bad connections.

Ground verification is done via pin 9 on the terminal and plug-socket connection.
For NEN-EN13922 application pin 9 is also used for detecting if a Vapour recovery hose is properly connected to the Tank-Truck when five-Wire sensors are used.

Note: The Vapour recovery hose is checked via pin 8 on a Tank-Truck equipped with Two-Wire sensors.

Note: Consult socket drawings for detailed information.

The 8800E Rack Monitor is capable of (auto-)detecting a resistive Ground connection as well as a Ground-Bolt (EL00001-E) connection on a Tank-Truck. Make sure connection between pin 9 and pin 10 via the Tank-Truck chassis is less then 1kΩ.

The two wire Thermistor sensors are simple component sensors with no active elements. This means the Rack monitor has to control the Thermistor sensor where a two-wire optic or compatible sensor has active elements and is self oscillating when dry.
As soon as the 8800E rack monitor has detected the Thermistor sensor it will supply power to heat the Thermistor bead from ambient temperature to a predefined high temperature this will be indicated on the LC-Display with a “H” and also the green indicators will flash from low intensity to high intensity. As soon as the thermistor bead reach the predefined high temperature the 8800E will switch off the power. The Thermistor will cool down until the predefined low temperature is reached. When a the Thermistor bead becomes wet the 8800E is not able to heat the Thermistor bead within the specified time and switch to NON-permissive.

System operation.

The purpose of the Civacon 8800E Rack Monitor liquid level sensing system is to detect a liquid point level signal from a sensor mounted in compartments of a tank truck, or storage tanks. The system provides an automatic signal to the rack automation equipment to shut-off the flow of liquid and warn of an impending overflow condition of a tank truck or storage tank It can detect up to 8 Two-Wire Sensors or 12 Five-Wire Sensors
As soon as the power is supplied, the monitor will perform a extensive self test of its internal functions (see power up test). If one of the test fails (except Led Test) a message will be shown on the Liquid Crystal Display. Also a red Led indicator will blink. (see troubleshooting chapter for details).
Make sure no vehicle is attached at power-up.

Note: The cable and plug connections shall be tested if a active storage hanger is used.

If all tests are passed the rack monitor is ready for use.
The first task of the 8800E Rack Monitor is to ensure proper grounding is established via Pin 9 and pin 10 of the plug socket connection to the tank-truck chassis. As soon as this has been ensured, two white Led indicators will flash inversely. Secondly the 8800E will check for shorts between sensors and shorts to ground for every channel and for open circuits. Then the 8800E Rack Monitor will determine sensor type and the amount of compartments. It can detect up to eight thermistors or Two-Wire sensors, up to 12 Five-Wire sensors and is fully compatible with the 3204E Onboard Retain Overfill Monitor.
If possible, the amount of sensors will be shown on the Display and Led indicators. (see sensor detection chapter for details).
The 8800E Rack monitor provides an “Auto switching” capability between Two-Wire sensors, Two-Wire Thermistor sensors and Five-Wire sensors.
If sensor type is selected, all sensors are dry and proper ground is verified the 8800E Rack monitor will communicates a Permissive condition to the automation equipment. When Thermistor sensors are used a waiting period has to be observed.
Of course the monitor can only be connected to one type of signal source at any one time. You cannot have Two & Five-Wire sensors connected at the same time. Although the 8800E/8801E Rack Monitor can detect and operate with a mix of Two-Wire sensors (Thermistor and self oscillating) it is not recommended.
The 8800E Rack Monitor systems uses self-checking principles to provide a continuous check on all system components. It also checks short circuits between sensors and ground and open circuits when connected to a tank-truck.
If at any time the 8800E Rack Monitor detects any kind of failure, a signal to the automation equipment will be send to shut-off the flow
All sensor failures are indicated on the two displays.

Normal operation.

The main task of the 8800E Rack Monitor is to provide a signal to the rack automation equipment to shut-off the flow of liquid as soon as a sensors in a compartment tank detect a liquid point level

When the rack monitor is not used for 15 minutes it goes into sleep mode.
During sleep mode the Red Led indicators will be dimmed and occasionally flash with high intensity to indicate " system ready in sleep mode".

As soon as the Plug is connected to the truck socket or removed from the active storage hanger the system awakes and is ready for use. If proper ground and dry sensors are detected the rack monitor will switch to permissive. When the loading is finished and the plug is removed from the truck it will wait 15 minutes before it goes back to sleep.

Liquid Crystal Display.

Liquid Crystal Display info at power up.
After power up the following messages will sequential appear on the LC Display.

```
01  P O W E R - U P   S E Q U E N C E   S T A R T E D
02
03  D i s p l a y     B o a r d
04  H a r d w a r e   V e r s i o n       : 0 1 . 0
05  F p               V e r s i o n       : 0 0 . 3
06  S o f t w a r e   V e r s i o n       : 0 0 . 6
07
08  M a i n           B o a r d
09  H a r d w a r e   V e r s i o n       : 0 0 . 2
10  F p               V e r s i o n       : 0 0 . 3
11  S o f t w a r e   V e r s i o n       : 0 0 . 7
12
13  C o n f i g   :   n o   f i l e
14
15  T I M E   S E T   T O   h h : m m : s s   D D . M M . Y Y
16  T E M P E R A T U R E   X X - º C
```

Note: Versions in the above shown figure are just an example.
Time hh means hours, mm means minutes, ss means seconds
Date DD means day, MM means month, YY means year.
The temperature is measured inside the box and NOT ambient temperature.
The real time clock is used for logging only and is factory set to Greenwich Mean Time.

Liquid Crystal Display info during normal operation.
After the power up sequence the 8800E will enter the normal operation mode. The following messages will sequential appear on the LC-Display.

```
01      S Y S T E M    R E A D Y
02      P L E A S E    C O N N E C T    P L U G
```

As soon as the plug is connected to the truck the following message page will appear.
(e.g. truck with Ground bolt and Two-Wire Dry sensors)

In line 4 the type of ground verification: Ground Bolt
In line 5 the type of sensors: Two Wire Sensors
In line 6 the amount of sensors:
In line 7 the state of the detected sensors: Dry
If all sensors are dry and a proper ground is verified the indication “permit to load “will appear at line 10.
If less then 8 sensors are connected and the remaining sensors are emulated with a dummy the rack monitor will indicate the remaining channels as dry Two-Wire sensors.

Note: only when special Dummy is mounted in the socket of the Tank-Truck. Else remaining channels will be indicated as Dry

```
01      S Y S T E M    R E A D Y
02      S O C K E T    D E T E C T E D
03
04  G R O U N D    V E R I F I C A T I O N      :  B O L T
05  S E N S O R    T Y P E    D E T E C T E D   :  2 W I R E
06  S E N S O R    D E T E C T E D              :  1 2 3 4 5 6 7 8
07  S E N S O R    S T A T E                    :  D D D D D D D D
08
09
10      P E R M I T    T O    L O A D
```

Note: If the plug is not connected to the truck socket it will go into sleep mode after 15 minutes.
The Red Led lamps will lit up every few seconds

An other example can be
(e.g. 12 compartment truck with ground loop and Five-Wire Dry sensors)

```
01      SYSTEM   READY   (EN13922)
02      SOCKET   DETECTED
03
04 GROUND   VERIFICATION      : BOLT
05 SENSOR   TYPE   DETECTED   : 5WIRE
06 SENSOR   DETECTED          : 12
07 SENSOR   STATE             : DRY
08
09
10      PERMIT   TO   LOAD
```

It can happen that during loading a sensor get wet. In this case the display will indicate the following.
(e.g. 12 compartment truck with ground loop and Five-Wire sensors and sensor in compartment 4 becomes wet)

```
01      SYSTEM   READY   (EN13922)
02      SOCKET   DETECTED
03
04 GROUND   VERIFICATION      : BOLT
05 SENSOR   TYPE   DETECTED   : 5WIRE
06 SENSOR   DETECTED          : 12
07 SENSOR   STATE             : WET   4
08
09
10      NO   PERMIT   TO   LOAD
```

Note: see appendix for more examples

Sensor detection.

The 8800E and 8801E rack monitor is an auto switching rack monitor and will detect automatically the 3 types commonly used overfill sensors. Before the rack monitor switch to permissive the following steps will be performed.

1. Individual short detection between sensors and ground.
2. Resistive ground detection via pin 9
3. Ground bolt detection via pin 9
4. Sensor type detection
5. Detected sensors complies to EN13922
6. Detected sensors complies to Rest Of the World specifications (ROW)
7. Detected sensors appears to work but not complies to the above specifications.

Note: Overfill sensors commonly used in industry are not necessary compatible with commonly used Rack Monitors in industry.
The specification of the ROW overfill sensor are based on an extensive worldwide sensor collection. All parameters of those sensors are collected and the boundaries are stored in a table inside the 8800E/8801 Rack monitor.

Note: The European Standard EN13922 describes the following points.
- *Functions*
- *Major components*
- *Characteristics*
- *Test methods*

Note: in some cases the rack monitor is still able to use the connected sensor as an overfill detection device. The operator will be asked to accept the detected sensor by using the Blue bypass key.

Step 1.
In this step the rack monitor is checking if all wires are connected to a sensor and there are no shorts between channels.
E.g. If on the tank truck one sensor is connected to two pins on the socket or one dummy channel is used to emulate two dry sensors the Rack monitor will detect this as a short and show this on the LC-Display.

Step 2. & 3
Although ground verification is continues it is mention in this document as a step.
Since many Tank-Trucks are equipped with a ground bolt the 8800E/8801E Rack Monitor will accept this automatically as a proper ground verification.
Be aware that conform the EN13922 in combination with Five-Wire sensor(s) the earth verification is connected in series with the vapour recovery hose interlock switch

Step 4.
The Rack monitor will apply power to the sensor and analyze the measured signal.
In case of a Two-Wire Thermistor sensor, a special algorithm will be used to heat the sensor to his operating temperature. This will be shown on the LC-Display with a H at Line 7
Also the Green LED indicator will change intensity until operating temperate is reached.

Note: Time to heat the sensor depends on ambient temperature and used Thermistor type.

07	S E N S O R S T A T E : H H H H H H H H

If no Two-Wire sensors are detected, power will be applied at channel 8 and a pulse will transmitted at pin 4
If a return pulse is detected the rack monitor will continue with Five-Wire senor(s).

Note: When the Rack Monitor is connected to already wet sensor(s) it cannot determine the parameters of that sensor.

All measured data will be compared with the stored settings and dipswitch settings.
If the dipswitch is set to EN13922 the Rack Monitor will continue with step 5
If the dipswitch is set to ROW the Rack Monitor will continue with step 6
If the measure data not complies to the EN 13922 or ROW the rack monitor will continue with step 7

Step 5.

If all sensors complies to the EN13922 standard and if all sensors are dry, a proper ground is verified it will switch to permissive.
In case of Five-Wire sensor and channel 9 (pin 9) is still an open channel or in case of Two-Wire sensor and a open channel 8 (pin 8) it will wait till the vapour recovery coupler is connected.

If everything is connected but one (or more) of the sensor(s) is (are) not conform the NEN-EN13922 the rack monitor will go to NON-permissive and will indicate the error on the LC-Display.
At this moment a Bypass Key is needed to start loading.
When the bypass key is used the rack monitor will leave the NEN-EN 13922 mode and the message [EN13922] on the LC-Display will be replaced with [ROW]. Now the rack monitor has switched to the Rest Of the World mode.
(See bypass chapter for details)

Note: In EN13922 a bypass key is not allowed. Therefore when a bypass key is used the rack will always leave the EN13922 mode.

Step 6.

If all (DRY) sensors are within ROW specifications and a proper ground is verified the rack monitor will go to permissive.
When the Dipswitch is set to 6 channels instead of 8 the rack monitor expect 6 dry channels on terminal pin 3 till 8. terminal pin 1 and 2 will be left floating. (this with any Two-Wire sensor).

Note: if more then 6 Two-Wire sensors are detected when the 8800E/8801E is set to 6 channels a warning will be shown on the LC-Display.

Step 7.
If the 8800E/8801E Rack Monitor cannot determine the type and/or amount of sensors it will go directly to unknown sensors detected and a bypass key is needed to continue. (See bypass chapter for details)

Possible abbreviation used in line 7 of the LC-Display

O	Open	
D	Dry	
W	Wet	
H	Heating	
+	Sensor Ok	
F	Faulty	
S	Short to other sensor	
G	Short to Ground	
?	Unknown sensor	
B	Bypassed	
N	Non Norm sensor	

Bypass operation.

Although the 8800E/8801E can also be bypassed in a faulty or wet sensor condition, it is not recommended. For safety reasons it is NOT possible to bypass the 8800E/8801E when no proper ground is detected with the standard bypass key. A special bypass key has to be used to switch the 8800E/8801E in total bypass mode. Special provisions should be made to make sure the truck with the compartments are discharged the build-up static electricity. Also during loading the chassis should be properly grounded (e.g. by means of a separate earth cable).

The 8800E/8801E bypass routine is able to bypass more then one event (“stackable“ bypass).
This means every time a non permissive situation occurs (except ground verification) the rack monitor can be set back to permissive to load by placing the bypass key in the designated location (see Bypass-key manual for details).
The wet or faulty condition will stay visual until the plug is disconnected from the truck socket.
During bypass mode two yellow LED indicators will flash inversely and a message will also be present on the LC-Display. The channel information will switch e.g. from W (WET) to B (Bypassed)

When the 8800E/8801E is bypassed it will automatically leave the EN13922 mode.

Note: The 8800E Rack Monitor will revert to normal operation as soon as the plug is disconnected from the truck and ready to service the next load.

8800E Interior.

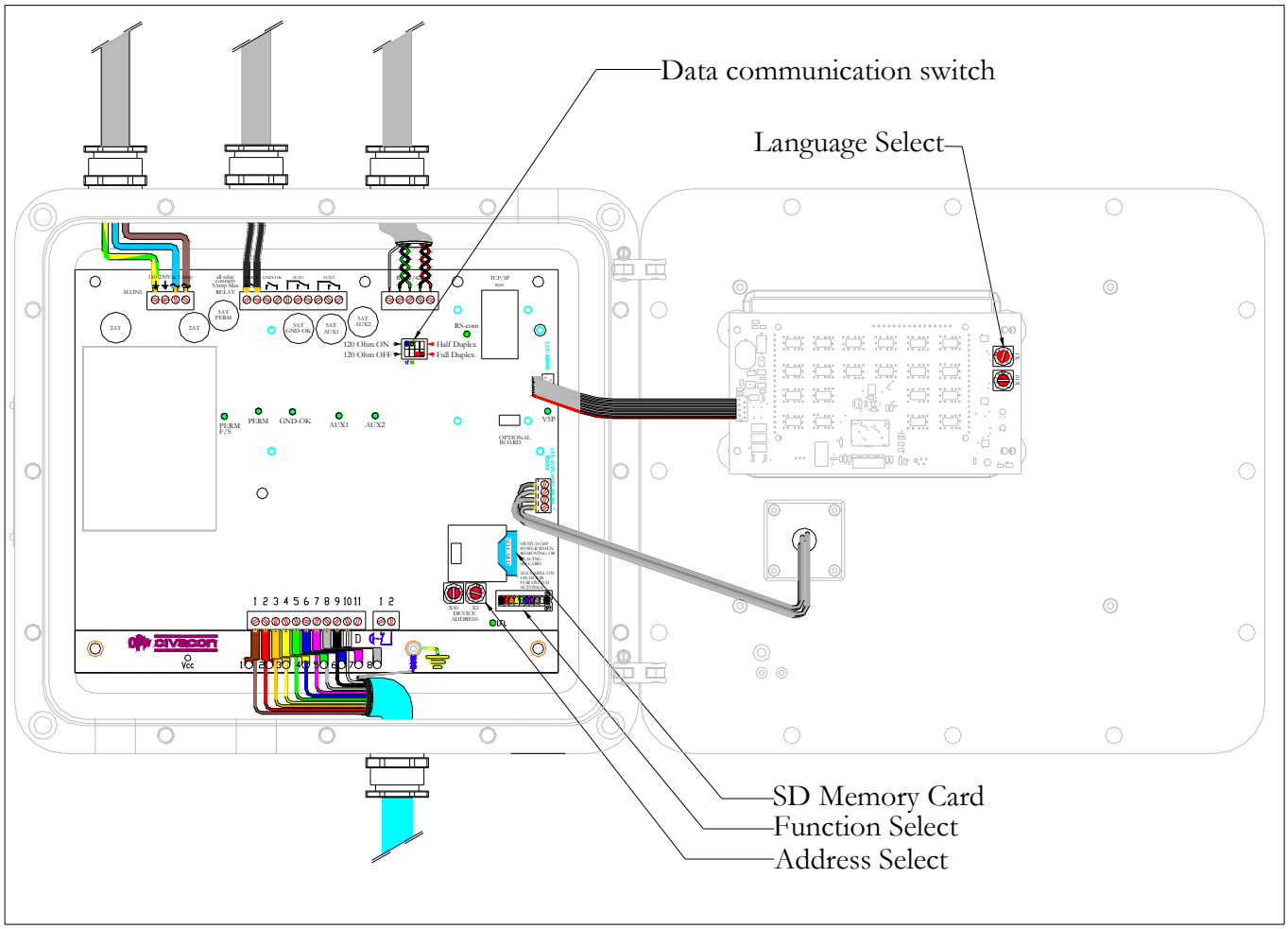


Figure 2

A schematic drawing of the interior is shown above in Figure 2
Close to the relays and output terminals is the data communication (hardware) switch situated.

At the bottom right side of the sensor terminal inputs the address rotary selector is placed.
Beside the address selector a colour coded function switch see label on the (inside) door for additional info
And above the switches just mentioned the SD card.
At the printed circuit board of the LC-Display the two rotary languages selectors are placed (designator SW1&2) and one extra in line switch (designator SW4)

Below a more in detailed description of the above indicated locations of the switches and memory card

Firmware upgrade.

The 8800E/8801E Rack monitor is build for the future therefore new updates to expand the functionality of this rack monitor can be expected.
To upgrade your 8800E/8801E rack monitor switch off all power to the rack monitor. Open the door (see installation manual for details) and if there is a memory card already placed at the lower right corner replace it with the new card. (see Figure 2)
Close the door (see installation manual for details) and restore power.
The rack monitor will copy the needed files from the card to its memory.
During update the main software the yellow indicators will flash rapidly and when the display software is updated the yellow indicators will flash a little bit slower. In both cases the update progress is shown with the 12 green compartment indicators. After updating the firmware the card will be used for Data logging.
Copying files from the card and installing will take approximate 10 minutes.
The new firmware will be supplied with a new appendix. Please save this appendix with this manual.

The rack monitor is ready for use if the screens are updated with the new version number at the first screen after power up.

Event log.

If the 8800E/8801E rack monitor is provided with a SD-card, all loading events are stored (time stamped)
The 8800E/8801E Rack monitor has his own Real Time Clock, factory set to Greenwich Mean Time (GMT)

Note: GMT does not change with daylight savings time!

The event file is stored as a CSV file with the name Rackmon.log . A minimum of three events are stored every load. Start loading (detecting), permissive (Sensing) and end of loading. Additional events are stored when the bypass key is used.

Dipswitch setting. “System”

Due to software upgrades not all switch settings are explained in this manual.
See Dip switch label on the inside of the box for functionality.
Already designated switches are:

Switch colour	Default	Function	Remarks		
• 1 Brown.	Off	EN13922 Compatible	Off = EN13922/ROW	On =Wide	
• 2 Red	Off	EN13922 / ROW	Off = EN13922	On =ROW	
• 3 Orange	Off	Compartments select	Off = 8	On = 6	*1
• 4 yellow	Off	--System--	Factory setting		
• 5 Green	Off	--System--	Factory setting		
• 6 Blue	Off	--System--	Factory setting		
• 7 Violet	Off	Contact OPW for latest software releases			
• 8 Grey	Off	Civacon protocol	Off = no comms burst	On = burst On	*2
• 9 White	Off	Contact OPW for latest software releases			
• 10 Black.	Off	Contact OPW for latest software releases			

*1 EN13922 selection will be ignored if set to 6 compartments.
*2 See chapter Data communication for details.

Languages settings.

Ask OPW Fluid Transfer Group Europe BV for available languages.

Communication settings.

Before data communication can be used four switches must be set (two sets).
The two left switches are for terminating the communication lines with 120 Ω
On (up) = terminated with 120 Ω Off (down) = NOT terminated

Both outgoing YZ as well as incoming AB channels are connected together when the two right switches are in the On (up) position.

Switch colour	Default	Function	Remarks	
• 1 Brown.	Off	Terminator Y-Z	Off = none	On =120 Ohm *3
• 2 Red	Off	Terminator A-B	Off = none	On =120 Ohm *3
• 3 Orange	Off	Full/Half Duplex	Off = Y-A open	On = Y-A Short *4
• 4 yellow	Off	Full/Half Duplex	Off = Z-B open	On = Z-B Short *4

*3 Switch 1 & 2 must be both on or both off.
*4 Switch 3 or 4 must set to terminate both lines with one 120 Ω.

Full Duplex:
The 8800E/8801E use terminal Y & Z for transmitting data and A & B for receiving data.
Half Duplex:
Since Y & Z are connected with A & B the 8800E/8801E will use A(Y) & B(Z) for transmitting **AND** receiving.

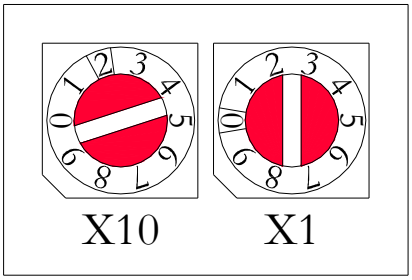
RS-485 (EIA-485)

RS-485 Balanced (differential) interface, Defines the Physical layer, **signaling protocol is not defined**. RS-485 specifies bidirectional, half-duplex data transmission. RS-485 can be made full duplex (like RS-422) however, since RS-485 is a multi-point specification, it is not necessary in many cases.
Up to 32 transmitters and 32 receivers may be interconnected in any combination, including one driver and multiple receivers (multi-drop), or one receiver and multiple drivers. The maximum of 32 devices is defined based on the Unit Load [UL] of each device [12K ohms]. The maximum devices on the net may be increased if the devices represent less then the UL [fractional unit load]. A number of devices are being produced which represent 1/4 or 1/8 the unit load. A maximum of 256 device could exist on the bus when each is at 1/8 the UL [96k ohms]. Repeaters may be used to extend the net to any number of devices. RS-485 requires a 120 Ohm line impedance terminations at both ends of the line (at the Receivers).
Pull-up/Pull-down resistors (Idle-line failsafe) at one end of the RS-485 bus may be used to bring the line voltage to a steady state (200mV) value at the end of a transmission; when all drivers are in the passive state.
No maximum bus length is given for RS-485, but ends up around 1200 meters at 200kbps or 50 meters at 10Mbps. The speed of the system and distance between devices is determined in large amount by the inter-connecting cable

The following signalling states are defined in the standards.
When the “A” terminal of the driver is negative with respect to the “B” terminal, the line is in a binary 1 (mark or Off) state.
When the “A” terminal of the driver is positive with respect to the “B” terminal, the line is in a binary 0 (space or On) state.
Note: Many types of equipment uses “-“ and “+” as terminal markings. In this case the “-“ terminal is equivalent to the “A” designation and the “+” terminal equivalent to the “B” terminal.

The 8800E/8801E is set to transmit and receive with:

9600 bps.
8 data bits.
No parity.
No handshaking.



Set above switches in a unique address to avoid collisions

Data communications.

The 8800E/8801E Rack Monitor can be set to emulate the 8500E data communication
In this way the 8800E/8801E is downwards compatible with the 8500E Rack Monitor.
To select this 8500E data communication set the grey (8) in the on position.
Every second a string will be send to e.g. the remote display.
At this moment no other protocols are supported.
Ask OPW Fluid transfer Group for latest development.

Civacon 8500 Protocol

Message Format:

STX	A1A2*	Command_Text	ETX	LRC

Where:

STX = Start of Text = 02 Hex
A1A2 = Address = 01-99 Hex

Command Text = Character string including Command Code and associated parameters

ETX = End of Text = 03 Hex
LRC = Longitudinal Redundancy Check

An underscore _ (5Fh) is used as a command Text delimiter
The LRC is a 7 bit ASCII character computed as the Exclusive OR sum of all characters following the STX and including the ETX characters.

Currently the following commands are defined

OS Overfill Status
VR Vehicle Recognition data
KD Bypass key Data

Currently the following commands are implemented

OS Overfill Status

Command Code OS – Overfill Status

Request Command: S_{TX}AA OSE_{TX}LRC.

Reply Message: S_{TX}AA OS_C1C2C3C4C5E_{TX}LRC

Where C1-C5 are defined in Tables 4~7.

Character 'C1' Definition

Table 4

Character	Hex Value	Sensor Permit	Ground Verified	Ground Loop
0	30			
6	36		X	X
>	3E	X	X	X

X indicates an asserted condition.

Character 'C2' Definition

Table 5

Character	Hex Value	2 Wire Sensors	5 Wire Sensors	Return Pulse
0	30			
4	34		X	
5	35		X	X
8	38	X		

X indicates an asserted condition.

Character ‘C3 & C4’ Definition

Table 6

Character	Hex Value	Sensor 4	Sensor 3	Sensor 2	Sensor 1	C3
	Value	Sensor 8	Sensor 7	Sensor 6	Sensor 5	C4
0	30					
1	31				X	
2	32			X		
3	33			X	X	
4	34		X			
5	35		X		X	
6	36		X	X		
7	37		X	X	X	
8	38	X				
9	39	X			X	
:	3A	X		X		
;	3B	X		X	X	
<	3C	X	X			
=	3D	X	X		X	
>	3E	X	X	X		
?	3F	X	X	X	X	

X indicates a wet sensor.

Character ‘C5’ Definition

Table 7

Character	Hex Value	Sensor 12	Sensor 11	Sensor 10	Sensor 9
0	30				
1	31				X
2	32			X	
4	34		X		
8	38	X			

X indicates a wet sensor.

Products.

All Civacon Loading Rack Monitors are suitable for hazardous locations with intrinsically safe (IS) outputs, and is housed in a Explosion Proof Enclosure (see installation manual for details)

Supplied accessories.

A blue IR key is supplied to bypass the rack monitor.
(except ground verification)
A special (RED) IR key to retrieve system diagnostic information.
Function key manual
Installation and Operation manual.

Optional system accessories.

7100E Blue Plug and 10-conductor individual screened coiled cable.
7215E 10-conductor individual screened coiled cable.
7450E Passive storage hanger.
75x0E Series junction box.
753xE Junction box with emergency switch. (contact OPW FTG for availability).

Maintenance.

When servicing the Rack Monitor 8800E/8801E the following needs attention:

- Before maintenance the full installation must be shut down/off before proceeding,
- Maintenance must be performed by authorized personnel only,
- All fasteners must be inspected periodically,
- After maintenance is performed, the Rack Monitor 8800E/8801E must be tested before the next use,
- Periodical inspection (every 6 months) for leakages (especially with heavy rainfall or wind),
- Periodically maintenance is not required, but we recommend to check the internals at least once a year, by tucking all the cables and if there is no corrosion,
- Depending upon the condition of the inside the enclosure after inspection, it may be necessary to apply a coating of corrosion inhibiting spray to the interior components,
- During servicing loading and unloading of tank trucks is not allowed,
- During maintenance (partial) disassembling could be necessary, the same risks and procedures apply as during installation,

Check Points.

During maintenance the following items should be checked:

- All earth cables should rigidly connected and free from corrosion,
- If there is no moisture inside of the enclosure,
- If the main seal is still intact and still soft and smooth,
- If there is no corrosion on any part inside the enclosure,
- Visual inspect all electronic components, with special attention for the voltage suppressors (also see trouble shooting in Troubleshooting.

Caution: When replacing the fuses, always make sure that you replace the fuse with original ones with an equal stated value.

When maintenance has been performed, the following should be done before closing the Rack Monitor 8800E/8801E:

- Replace the corrosion protector (should be done every 6 months),
- Put grease on the main seal,
- Make sure that all earth cables are connected,
- Apply coating (if necessary) to the interior components,

Caution: - Make sure, before closing the enclosure, that the cables do not get stuck between the door and the bottom side of the enclosure.
- When tightening the bolts, apply the torque mentioned in the installation manual.

Troubleshooting.

The following troubleshooting guide will give you first aid hands-on in solving most of the problems you can encounter.
there are two types of problems.

1. operational issues.
2. hardware problems.

Most commonly are the operational issues. Caused before or during loading a Tank-Truck.

The amount of hardware problems will increase if the 8800E/8801E Rack Monitor is NOT serviced on a regular base. Especially the cable and plug are subject to wear out. Although a high quality cable is used it cannot withstand the strength of a Tank-Truck. Also dirt can build up between the spring-loaded pins and the insert of the plug. If pin 10 is not moving in the insert of the plug an electrostatic discharge via other pin can damage the input circuits of the 8800E/8801E Rack Monitor.
Therefore check cable and pins/plug on a regular base to avoid traffic block on a loading bay.

The common operational issues are wrong, defect or poor connected sensors. In some cases a not correct adjusted sensor can cause a premature (or delayed) shutoff of the loading procedure.
If the 8800E Rack Monitor does switch to the permissive state it will show the most probably cause on the LC-Display
The 8800E findings are based on the measured data and its conclusion might not be the correct conclusion.
In this unlikely case the Red Bypass Key must be used to show the most relevant sensor data on the Diagnostic screen (on the LC-Display).
If the 8800E/8801E Rack Monitor is set to accept only EN13922 compliant sensors, it will reject ALL sensors and wiring which is not according this standard. This will be shown on the LC-Display and can easily bypassed with the Blue Bypass Key. (8800E/8801E Rack Monitor will switch back to ROW sensors)
Since this is a new standard a lot of Tank-Trucks might not be wired according this standard or the sensors are on the boundary of the EN13922. During this transition period the 8800E/8801E Rack Monitor can be set to ROW (Rest Of the World) values by means of placing the Brown switch in the ON position.

e.g. previous On Board Monitors (OBM or ROM) can be connected with shorted channels and since the EN13922 will refuse shorts it will NOT go to the permissive state.

Note: Faulted channels, for instance “Open Wire” can not be bypassed with the Blue Bypass key and the Red Bypass key must be used

Condition	Possible Cause	Solution
- The Rack Monitor 8800E/8801E doesn't turn ON	- The mains isn't connected.	- Connect the mains. - Check if the main wiring is connected according to the installation instruction. - Check if there is any power available at the terminal of the Rack Monitor 8800E/8801E.
	- The fuses are broken.	- Replace the fuses for new ones.
- System goes directly into 'NON PERMISSIVE'	- The dead man switch is not connected.	- Connect the cable according to the installation manual. - Connect a bypass wire between pin 1 & 2 according to the installation manual.
- System does not indicate correct amount of compartments in 5-Wire mode	- bad connections in sensor housing and/or plug/socket.	- Check green and white wires - Clean pin 5 and 10 on plug and socket

For all other possible inflictions/damages to the Rack Monitor 8800E/8801E, contact **OPW Fluid Transfer Group Europe BV** and ask for assistance to obtain a safe and right use.

Annex A – Additional Electrical Drawings

Annex B - Recommended Spare Parts

With the purchase of the Rack Monitor the **OPW Fluid Transfer Group Europe BV** recommends some spare parts to be purchased. Although this Rack Monitor 8800E/8801E is designed with solid state lamps and a minimum maintenance spare parts are available. When parts are replaced, it is recommended to replace them with the original parts.

When using the Rack Monitor 8800E/8801E for its intended use and the normal environments these spare parts will be useful at the end of the lifecycle of the given parts, but they have been known to be necessary to resume working swiftly after replacing these parts.

The recommended spare parts are:

Part number	Description	Quantity
H71197	Main Seal	1
H71307	Corrosion Protector VCI-101/ACF-50	1
EL04141	Mains power input Fuse 2AT	1
EL04142	Relay contact output Fuses 5AT	1

The following parts are also available:

Part number	Description	Quantity
EL04139	Liquid Crystal Display cable assembly	1
EL00203-CRK	Internally used connector kit	1
BCU-BLUE	Blue Function key (low level)	1
BCU-RED	Red Function key (high level)	1
EL06802	SD-Ram Card	1
8800-BRK	Fastener kit 12x Door Bolts	1
H71342	Installation manual	1
EL05104	Cable gland M20x1,5 Ø cable diameter 10-14mm ATEX-Ex/d (not armed)	1
EL05134	Cable gland M20x1,5 Ø cable diameter 3.1-8.6mm ATEX-Ex/d (not armed)	1
7400E	Black Plug and 10-conductor individual screened coiled cable.	1

Annex C – Certificates

- NEN-EN-ISO 9001:2000 Certificate.
- Quality certificate.
- ATEX certificate.

LRQA
Business Assurance

CERTIFICATE OF APPROVAL

This is to certify that the Quality Management System of:

OPW Fluid Transfer Group Europe B.V.
Nieuw-Vennep, The Netherlands

has been approved by Lloyd's Register Quality Assurance
to the following Quality Management System Standards:

ISO 9001 : 2008

The Quality Management System is applicable to:

Engineered Products for the Transfer, Monitoring, Measuring and Protection of Hazardous Fluids for the Chemical, Petroleum and Food Industry.

Approval Certificate No:
RQA654734

Original Approval	:	6 March 2001
Current Certificate	:	1 April 2011
Certificate Expiry	:	31 March 2014

Issued by: Lloyd's Register Nederland B.V.

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RvA C 010

This document is subject to the provision on the reverse
Weena-Zuid 170, 3012 NC Rotterdam, The Netherlands - KvK nr. 24247948
The approval is carried out in accordance with the LRQA assessment and certification procedures and monitored by LRQA.

Quality Certificate

Functional Inspection

We ***OPW Fluid Transfer Group Europe BV***
of Roggestraat 38
2153 GC Nieuw Vennep
The Netherlands
T: +31 (0)252 660 300

declare that:

Product description	: Rack Monitor 8800E/8801E
Item number	: 8800E/8801E
Serial no./ Lot no.	:
Brand name	: Civacon

has satisfactorily passed a manufacturing quality check, containing a functionality test, a dimensional check and a visual inspection.

All tests are in accordance with the ***OPW Fluid Transfer Group Europe BV***, 'General Test and Inspection Plan'.

Place : Nieuw Vennep Date :

Quality Control Inspector

(Authorized signatory on behalf of OPW Fluid Transfer Group Europe B.V.)