Nederman

Installation manual

Lubrication Equipment

Nederman Monitoring System

Installation of NMS 3.0 equipment

Original installation manual

EN INSTALLATION MANUAL

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1 Preface

Thank you for using a Nederman product!

The Nederman Group is a world-leading supplier and developer of products and solutions for the environmental technology sector. Our innovative products will filter, clean and recycle in the most demanding of environments. Nederman's products and solutions will help you improve your productivity, reduce costs and also reduce the impact on the environment from industrial processes.

Read all product documentation and the product identification plate carefully before installation, use, and service of this product. Replace documentation immediately if lost. Nederman reserves the right, without previous notice, to modify and improve its products including documentation.

This product is designed to meet the requirements of relevant EC directives. To maintain this status, all installation, maintenance, and repair is to be done by qualified personnel using only Nederman original spare parts and accessories. Contact the nearest authorized distributor or Nederman for advice on technical service and obtaining spare parts. If there are any damaged or missing parts when the product is delivered, notify the carrier and the local Nederman representative immediately.

2 Safety

2.1 Classification of important information

This document contains important information that is presented either as a warning, caution or note, according to the following examples:

⚠ **WARNING! Risk of personal injury**
Warnings indicate a potential hazard to the health and safety of personnel, and how that hazard may be avoided.

⚠ **CAUTION! Risk of equipment damage**
Cautions indicate a potential hazard to the product but not to personnel, and how that hazard may be avoided.

ⓘ Notes contain other information that is important for personnel.

3 NMS Monitoring System

Nederman Monitoring System hereinafter referred to as NMS .

This fluid monitoring system reports consumption of fluids in workshops, automotive service centres etc. to a PC running the NMS administrative software. It consists of input terminals and control and measuring units, all flexibly connected to the supervising PC via a field bus system.

The field bus system SIOX used by Nederman is a tested and proven system that has been in use for approximately 30 years in workshops, industries, ships and buildings.

The bus loop can be extended and connected with very little regard to the layout (series, star-network, and branch extensions) as long as it is not short-circuited. No special cable or screening is needed, just two ordinary wires in the same way you would parallel connect several lamps. Further, different from most communication systems, no termination resistors at the ends of the bus will be needed.

For a standard installation of an NMS, a communication speed of 9600 bps is used and the maximum total bus cable length should then not exceed 500 m. If a longer bus is required, the speed of all units in the loop can be reduced to 4800 bps or a signal amplifier be installed for every new 500 m. At 4800 bps the bus can be up to 1000 m without amplifiers. The cable that Nederman use for the combined bus and power supply for valves is LIYCY 2x2x0.75. When transformers are placed far off from the valve control units, the heavier cable is recommended so as not to cause excessive voltage loss, e.g. 2x2x1.5.

Up to 63 units of types ST4-T, ST4-7T, ST4-7, ST4-2 and R02 can be connected to the bus. A serial converter type SIOX-0 (USB PC port) isolates the central PC from the workshop.

Valve handling modules for 7 or 2 taps each are then located on the bus. Mini-terminals, into which the mechanics feed the work order nos., are also connected to the same bus.

R02 sensor units containing pressure sensor(s) to read the volume of the fluid tanks in NMS can also be attached.

The valve handling units open the solenoid valves and count the volume pulses from the pulse generators. They may be of the types ST4-7T or ST4-7 (7 channels) or ST4-2 (2 channels). These modules can also be used to open and close solenoid valves or contacts so that no media are under pressure when no order is active.

3.1 Technical Data

Bus Speed	9600 bps
Maximum Bus Length	500 m
Recommended Cable	LIYCY 2X2X0.75 or LIYCY 2X2X1.5

4 Legend

The following physical units are part of the NMS 3.0 system:

Nederman article No	IFS Description	Referred TO as
30514050	Fieldbus Converter + NMS software	ST4-0
30512850	ST4 Operator Terminal + 7 I/O-channels	ST4-T7
30512950	ST4 Operator Terminal	ST4-T
30513050	ST4, 7 I/O-channels	ST4-7
30513150	ST4, 2 I/O-channels	ST4-2
30513250	Transformer 96 VA 24 VAC/DC	
30513350	Transformer 220 VA 24 VAC/DC	
30513450	Keyswitch, manual override, EU	ST4-KS
30513550	Transmitter unit R02, 1-2 Tanks	R02

5 I/O-cabinets ST4-7T and ST4-7

The ST4 comes in several options to suit individual installations. ST4-7 handles 7 valves and their associated pulse counters. The unit ST4-7T also includes the operator panel on top of the ST4-7.

5.1 Product Description

I/O-cabinets are used in vehicle repair shops to register fluid tapings such as oil, windscreen fluid and anti-freeze. The units are controlled by a software program called NMS which is installed on a PC.

The software communicates with each tap through a two-wire field bus, monitoring all I/O-devices function and controls them so that the device opens and closes the solenoid valves either at preset or at free fluid volumes. The solenoid valve opens when the operator inputs an order number on the terminal, operator PIN, tap and volume. The fluid tapings will be registered in a database when the order is closed in NMS.

5.2 Technical Data

Casing	Polycarbonate 180x130x45 mm
Casing Class	IP54
External Temperature	0 - 50 °C
Voltage	21 – 27 VAC, 50 – 60 Hz or 20 – 30 VDC
Internal Consumption	20 mA
Max Power Load	5 A
Fuses	Each valve output includes an electronic, self-resettable current limiter at 4 A_{peak}. AC loads above 2.8 A_{eff} will thus be regarded as involuntary shorting of a valve and switch on and off the output to prevent damage to the output and the mains transformer.
Inputs	7 taps, max 1000 pulses per litre. The pulse generators Nederman use generates 100 pulses per litre.
Outputs	7 taps 24 VAC, max 2 A / tap

5.3 Mounting Instructions

The I/O-cabinet must be mounted in a location where it is possible for air to circulate, typically on a wall. The location must be dry (normal workshop environment) and should not be exposed to moisture. The cabinet is fixed using the 4 holes concealed beneath the panel screws in the corners, using 4 screws suitable for the wall type. A four-lead cable for external power supply and communication bus is preinstalled on all ST4-7.

If a keyboard is included, it will be connected to the main unit by a flat cable, which can be removed. DO NOT pull the cable, only the black connector, since the cable is vulnerable. Do not touch any electronic components on the bottom board, since they are sensitive to electrostatic discharge.

5.4 Transformers

All modules except ST4-0 are supplied from 24 VAC, delivered from one or several transformers. It is possible to use 24 VDC if permitted by the valves in use. For DC supply, it is important to connect the terminals marked (+)24V to the positive supply and the GND terminal to the negative supply.

NOTE!
Switches shall be labelled as switches to NMS valve system.

CAUTION! Risk of equipment damage

- Installation and replacement of mains transformers must follow the regulations in each country.
- Internal fuses and external safety switches are typically mandatory.
- Connecting the supply voltage must be performed by a qualified electrician.

The recommended wiring, $2 \times 0.75\ mm^2$, must not carry loads larger than 10 A to avoid over-heating. This cable exhibits a 5-volt drop for every 10 meters when a transformer is loaded by 10 simultaneously operated valves. Such losses may render valves inoperative. Longer wires may equally well be e.g. $2 \times 1.5\ mm^2$ to reduce losses. Else it is generally best to install several small transformers in a wide-spread system with many valves. The installed units for each transformer need no common reference.

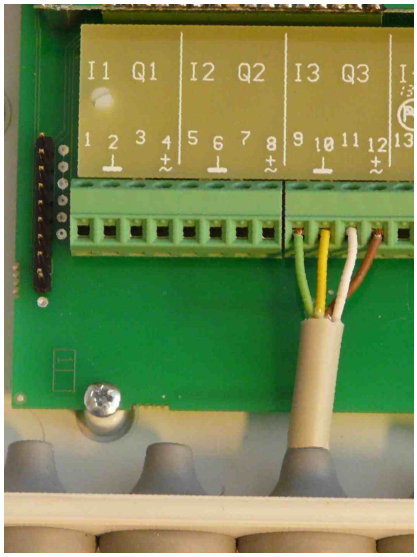
The two wires from the communication bus will be wired to all I/O and Terminal units. In most cases, it will be convenient to use a combined 4-conductor cable, although communication runs with much lower current levels. The power wire pair is then interrupted at the end of modules supplied from one transformer, while the communication wire pair runs to all the units in the whole system. Communication will not become disturbed by the separate 24V AC/DC, as long as they are electrically isolated from each other.

5.5 Connection of I/O-units

The ST4 is delivered with a short four-conductor cable. The white and brown wires connect to a suitable 24 V transformer/supply (AC or DC), while the yellow and green are for the SIOX bus, running through the whole installation. If a DC supply is used, the brown wire must be positive, or the unit will not operate. Do not extend this cable further, but connect to the heavier recommended transformer wiring as described above.

When the four wires to the system are installed, the wires to the taps can be cared for. Each tap cable includes two wires from the pulse counter and two wires to the valve. Push the cable through the adjacent rubber grommet and install the pulse counter wires to terminals 1-2, 5-6, 9-10, 13-14, 17-18, 21-22 or 25-26, depending on the tap number. Install the valve wires to terminals 3-4, 7-8, 11-12, 15-16, 19-20, 23-24 or 27-28.

The photo shows the tap 3 connection with the pulse input connected to terminals 9 and 10 and the valve output to terminals 11 and 12.

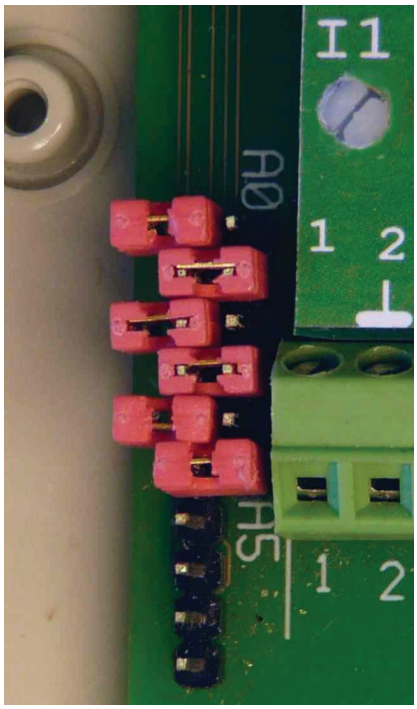


Each output has an automatic software check to protect against the valve wires becoming short-circuited. At currents above 4 A_{peak} an active output will toggle on and off to avoid overheating. This operation protects the outputs and the power supply until the short has been removed. The fault is reported back to the PC for correction. The protection, however, does not cover all types of wiring errors, so please check the installation carefully before starting the unit.

5.6 Addressing the Module

All modules installed on the bus must have an individual address to allow unique communications with it. ST4-7T with its keyboard and display uses menus to select the address and other functions. These menus are described in Chapter 7 Mini-Terminal ST4-7T and ST4-T. ST4-7 has no menus possible, so mechanical bridges in the lower-left corner of the module are used to select the address. The bridges are marked A0 – A5 and their respective weights are 1, 2, 4, 8, 16, and 32. Removing a bridge adds its weight to the address. All installed would set the address 0, which is illegal and all bridges removed would set 1+2+4+8+16+32=63, a reserved address for other ways of defining the address. The picture shows bridges with values 1, 4 and 16 removed = address 21.

When setting the address bridges, the ST4-7 will only read their positions after a power-up or a general reset issued from the PC.



5.7 Using I/O-cabinets to Control Pumps

I/O-cabinets can alternatively be used to open and close solenoid valves and contactors for air and electric pumps so that the tubing systems will not be under pressure when no fluids are being tapped. The solenoid valves and contactors are connected in the same way as in the I/O-cabinets for taps. Pulse generator inputs are left unconnected.

If I/O-cabinets with free outputs have been installed near the oil room, an alternative option is to use these outputs to manage such pumps.

5.8 Maintenace

I/O-devices require no ongoing maintenance.

However, it may be appropriate that a few times a year check the safety switch, supply cable condition and that the space around the cabinet is free so that air can circulate.

5.9 Replacement Parts

The customer is free to replace parts subject to the supply first being disconnected by the safety switch. These parts may be replaced by the customer: I/O and terminal modules and fuses.

The transformer has to be replaced only by a qualified electrician.

6 I/O-cabinet ST4-2

An alternative tap controller for just two valves is based on different hardware called SD2. It operates just as an ST4-7 with only two valves installed, except that it has 8 A relay outputs for higher loads.

6.1 Technical Data

Casing	Polycarbonate 92x92x65 mm
Casing Class	IP65
External Temperature	0 - 50 °C
Voltage	21 – 27 VAC, 50 – 60 Hz or 20 – 30 VDC
Max Power Load	2x8 A
Inputs	2 taps, max 1000 pulses per litre
Outputs	2 taps 24 VAC/DC, max 8 A / tap

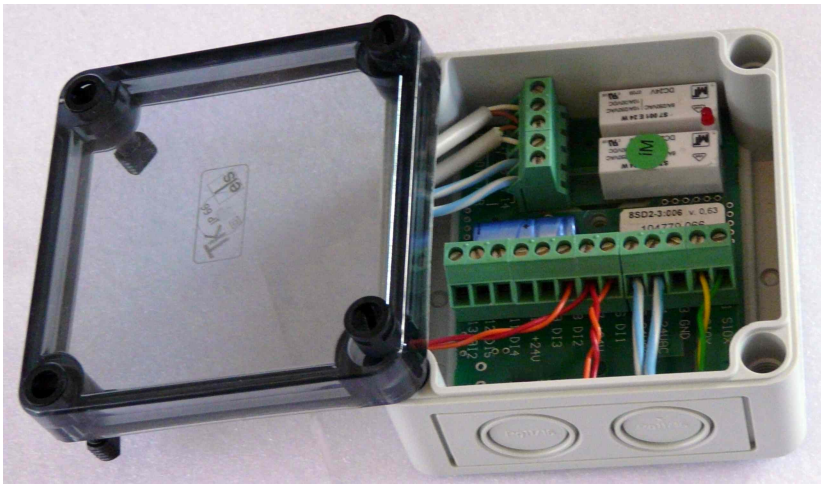
6.2 Connections

The same precautions as with an ST4-7 must be cared for:

An external safety switch has to be connected ahead of the I/O-cabinet, typically near the transformer. The switch shall be labelled as a switch to NMS I/O-device.

Connecting the mains supply voltage must be performed by a qualified electrician.

The screw terminals in the picture below are numbered from right to left with 1 – 13 and continuing with 5 more terminals at the top left, 14 – 18. The two wires from the communication bus are wired to terminals 1 and 2, polarity independent. Power to the module, 24 V AC or DC, is input via 4 and 5. The unit includes two push-through grommets, but other types of glands are possible. If you open one of the break-out holes in the walls, be careful not to damage the circuit board with the screwdriver or knife.



The wires to the taps connect to 6 and 7 (tap 1) and 8/10 and 7, (tap 2).

Terminals 14 – 18 connect the valves, pumps etc (see below). Power to these loads must not necessarily be the same as the rest of the system, since terminals 14 and 15 are separate from the rest of the module. Only if the same supply shall be used, connect 14 and 15 to 4 and 5. The valves are now connected to terminals 16 and 17 (valve 1) and 17 and 18 (valve 2).

Terminals 3 and 9 – 13 are normally left unconnected.

6.3 ST4-2 Addressing

This module uses addressing via bridges on a 2×6 pin row, just like the ST4-7. Removing a bridge from either A0/A1/A2/A3/A4/A5 adds the address value 1 / 2 / 4 / 8 / 16 / 32.

6.4 Using I/O-cabinets to Control Pumps

I/O-cabinets can alternatively be used to open and close solenoid valves and contactors for air and electric pumps so that the tubing systems will not be under pressure when no fluids are being tapped. The solenoid valves and contactors are connected in the same way as in the I/O-cabinets for taps. Pulse generator inputs are left unconnected.

If I/O-cabinets with free outputs have been installed near the oil room, an alternative option is to use these outputs to manage such pumps. ST4-2 is particularly suitable for this, due to its large load capacity.

6.5 Replacement Parts

All parts of the I/O enclosure are provided by Nederman. The customer is free to replace parts subject to switching off the supply to the cabinet by means of the safety switch. These parts may change by the customer: I/O-module, terminals and fuses. The transformer has to be replaced only by a qualified electrician.

7 Mini-Terminal ST4-7T and ST4-T

The terminal comes in two versions. The ST4-T only functions as a terminal, while ST4-7T also includes all I/O-components to operate up to 7 valves.

Any tap may be opened from any ST4 terminal by entering the order number, the operator code, the tap, and the desired volume.

7.1 Technical Data

Casing	Polycarbonate 180x130x35 mm
Casing Class	IP65
External Temperature	0 - 50 °C
Voltage	21 – 27 VAC, 50 – 60 Hz or 20 – 30 VDC (The Terminal unit remains operative down to some 12 V supply)
Power Consumption, Excluding Valves	50 mA

7.2 Connecting the Mini-Terminal

The ST4 is delivered with a short four-conductor cable. The brown and white wires connect to the 24 V supply (AC or DC), while the yellow and green are for the SIOX bus. If a DC supply is used, the brown wire must be positive, or the unit will not operate. If the terminal includes valve outputs, do not extend this cable further, but connect to the recommended transformer wiring to avoid unnecessary voltage drop.

The full ST4-7T also includes control of up to seven taps. For their installation, please refer to the ST4-7 I/O-module description in Section 5.5 Connection of I/O-units.

If necessary, it is possible to install the ST4-T with the two cable outlets pointing downwards. This is not recommended for ST4-7, since the seven rubber outlets cannot guarantee full protection from accidental water if they are situated on top of the case. When required, loosen the outlet nut and remove the four screws fixing the main PC board. While feeding more cable, rotate the board 180° and install the four screws again, starting with the two behind the display.

7.3 Setup of ST4 Mini-Terminal

To enter the setup menu hold down the ENTER button for at least 2 seconds. If required a special 4-digit PIN code must be entered within 5 seconds after the 2 seconds to get access to the menus to avoid involuntary modification of the unit. This code is set at delivery to 0, no code needed. Please contact Nederman if you need to set a PIN code.

Terminal Setup Spy	Press the down arrow until the cursor blinks on Setup. Press E (Enter).
ST4 ver. X.XX Setup	Press Enter.
Module Address 01	Press the left or right arrow to scroll up or down to the desired address. Press Enter.
Bit Rate 9600	Press the left or right arrow to set 9600 baud (if an old system is being expanded, correct speed may be 4800). Press Enter.
Display Contrast 08	Press the left or right arrow to set the appropriate display contrast. 08 is usually the best. Press Enter.
Key Beep ON	Press the left or right arrow to select whether a short beep shall sound at each key pressure. Press Enter.
-	When an empty pane reappears, the settings are completed.

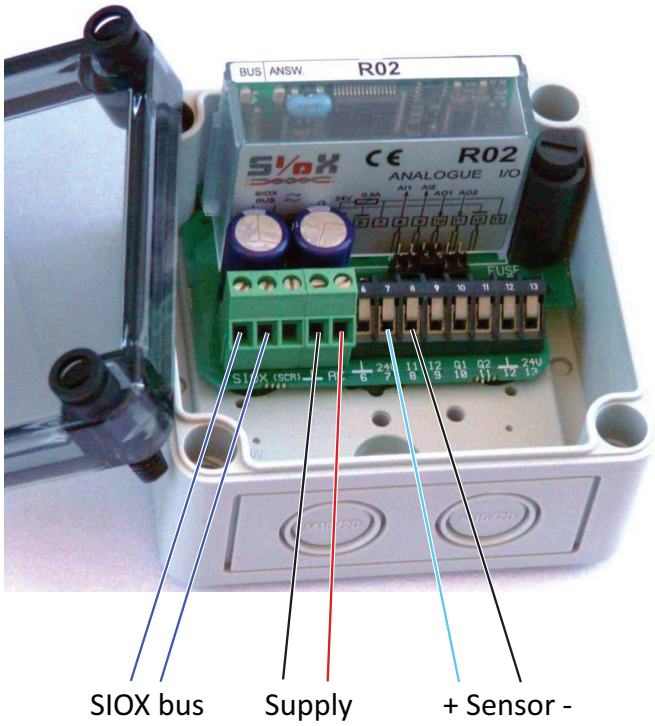
8 Tank Level

Tank levels can be measured in NMS by installing a pressure sensor in the tanks to be monitored by connecting a sensor unit R02 inside or near the oil room.

8.1 Sensor Unit R02

Connect the R02 module according to the picture.

- Connect to four wires for communication and supply to terminals 1-2 and 3-4. The communication bus is unpolarized. The supply may be one of the transformers installed or a separate small 24 V charger unit. The R02 itself consumes only 10 mA, so 50 mA including 2×20 mA for the sensors is adequate. When using a DC power supply, connect the positive lead to terminal 5.
- The pressure sensors are connected to terminals 7 – 9.
- Terminal 7 is common to both sensors and is the locally rectified supply.
- Terminals 8 and 9 are the input signals. (4-20 mA)



8.2 Addressing

R02 is addressed in the same way as other I/O-modules, i.e. at the bottom of the unit bridges are removed to add an address value. Since addressing of R02 normally begins at address 51, the bridges 32, 16, 2 and 1 are lifted and removed.

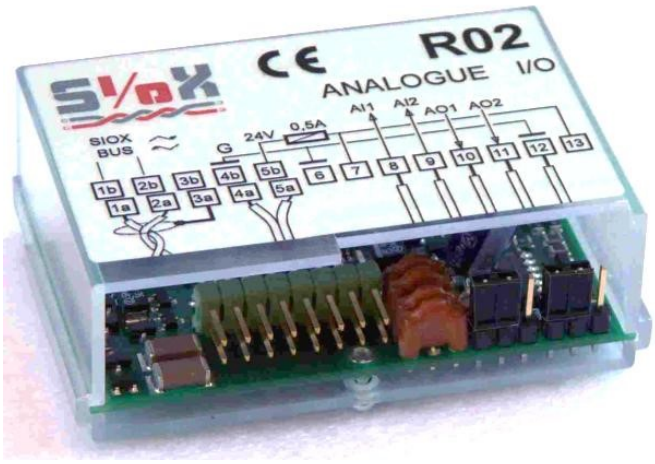
8.3 Pressure Sensor

The pressure sensors used are dual-wire sensors 4-20 mA 0-500 mBar. They can be used for tank heights up to 5m.

When connecting the pressure sensors make sure which wires are for the voltage supply.

Since the inputs on R02 can be used for different types of input signals, R02 may also have to be bridged to function with the pressure sensors used. The pressure sensors used to generate output signals of 4-20 mA. Two corresponding bridges are preinstalled, each to the left on a row of three pins in the bottom of the plug-in unit, as shown on the picture.

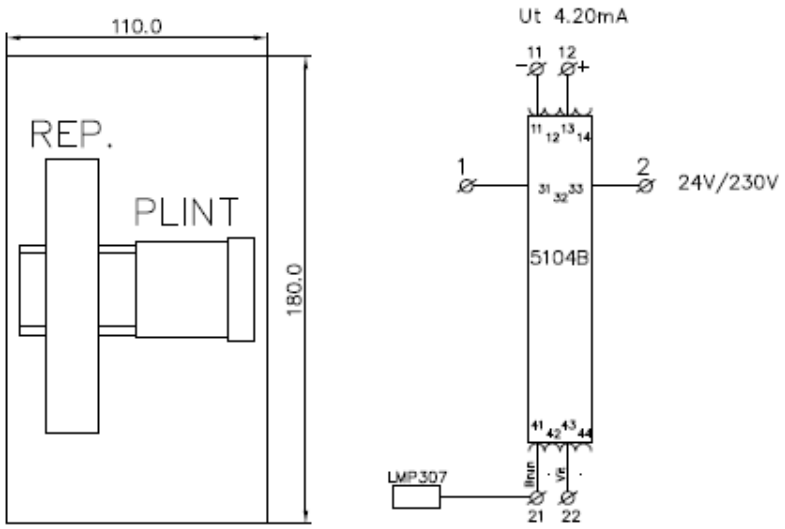
For different inputs, e.g. 0-10 V, remove the corresponding bridge and connect the signal between terminals 6 (GND) and 8 or 9, respectively. Note that additional scaling of the signal in the software of the module may be necessary.



8.4 Installation of Pressure Sensor in an Ex Zone

If you want to determine the level in a cleansing fluid tank, an Ex-barrier and a pressure sensor approved for zone 0 (inflammable liquid or gas) must be used. The Ex-barrier and R02 must then be mounted outside the Ex zone.

When installing a tank level sensor for ordinary oils and the tanks are situated in an Ex zone, the pressure sensors must also be mounted after an Ex-barrier. However ordinary pressure sensors can be used if they are not immersed in a flammable liquid.



Connect input voltage 24 V – 230 V to terminals 1 and 2.

Connect terminal 11 (-) to terminal 8 or 9 in R02 depending on which channel is used. Connect terminal 12 (+) to terminal 7 in R02.

Connect terminal 21 to signal cable (-) to the pressure sensor and connect terminal 22 to the feed input (+) to the pressure sensor.

9 Bus Converter ST4-0

One such unit is needed for every NMS system. It converts the computer's USB signal into a field bus signal (SIOX).

It is placed near the central computer since the permitted length of the USB cable is limited. Install Bus cable from I/O-box no:1 according to the picture. Bus Converter will be power supplied from I/O.

9.1 Connecting

The two top wires in the photo are where the communication bus originates. It shall be wired in parallel to all other units in the system. The polarity is not important and the bus tolerates short-circuits, although it cannot communicate during a short. The bus voltage can be checked by measuring directly across the wires. It should read 20 - 24 V when the PC has not started any communications and a few volts less and fluctuating a little when the system is operative.

10 Bus Extender R30

NOTE!
Please contact Nederman before installing.

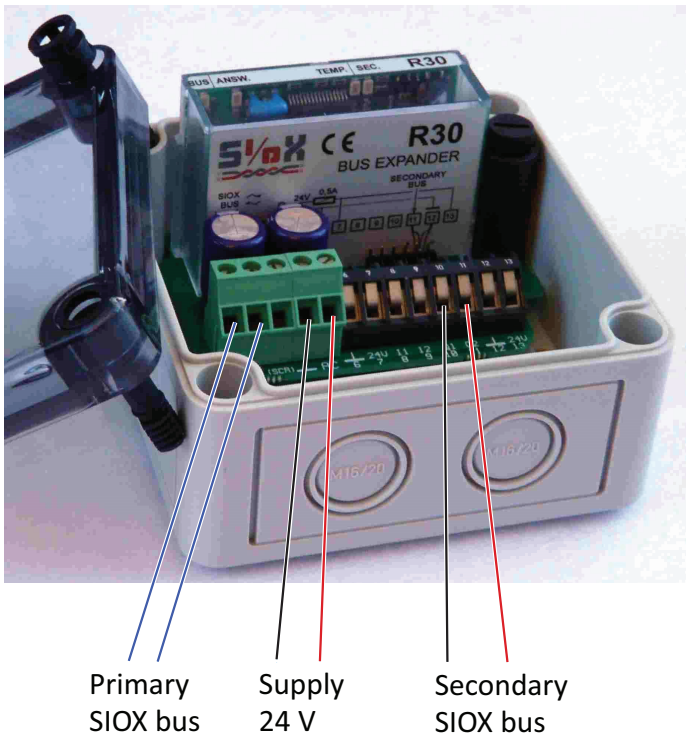
If the bus cable length exceeds 500 m for 9600 bps, an R30 bus extender (amplifier) should be inserted approximately halfway down the bus.

It is powered from a 24 V AC or DC power supply, typically the one that supplies the nearest I/O or terminal unit or a small separate 24 V supply.

10.1 Connecting

To achieve the best possible effect from the bus extender, it should be mounted reasonably close to the middle of the total bus cable length.

The primary side coming from the central PC is connected to terminals 1 and 2 and the supply voltage to terminals 4 and 5. The supply may be either 24 V AC or DC, typical the same supply as is used for some of the I/O-units. The theoretical maximum consumption of an R30 is 120 mA, so it loads the supply very little. Using a DC supply, make sure that the positive wire is connected to terminal 5.



The secondary side is connected to terminals 11 and 12. 11 is internally connected to (the Ground) terminal 4, making the secondary bus half susceptible to involuntary connections between the supply and bus at other I/O-units.

All six addressing bridges in the bottom of the module must be lifted away so that the R30 expander gets the address 63. This is already done before delivery, as well as setting the communication rate to 9600 bits/s. Only at very unusual installations will these conditions have to change.

11 Key Switch Unit ST4-K

If the central PC is down, it is still possible to open the valves by installing a key unit to unlock the ordering system. When the key is turned on in this unit, all valves are allowed to open without any work orders. To avoid misuse, the module must be installed in a safe location and the opening key stored safely.

11.1 Technical Data

Casing	Polycarbonate 92x92x65 mm
Casing Class	IP65
External Temperature	0 - 50 °C
Voltage	21 – 27 VAC, 50 – 60 Hz or 20 – 30 VDC

11.2 Connections

Like all other modules, the key connects to the SIOX bus wires and to 24 VAC. The two wires from the communication bus, typically green and yellow, are wired to terminals 1 and 2, polarity independent. Power to the module, 24 V AC or DC, is input via 4 and 5 using brown and white, also polarity independent.

When the key is inserted and turned clockwise during a central PC failure, the unit will send coded unlock orders to the other I/O-units. The I/O-unit will turn on all valves to allow pistol handles to output liquids.

No orders can be registered without the PC. To return to normal, turn the Key back and remove it.

Sometimes the transformers may be inadequate to supply all valves simultaneously. In this case, the I/O-units will identify a failing supply voltage and switch off some valves to reduce the load. To allow all outputs, units will be switched off in a round-robin fashion.

12 Typical Installation

12.1 Checking the Connection

When all I/O-cabinets and terminals are connected and all bus and supply cables are attached, the live voltage supply may be switched on. Cabling can be checked before or during operation by measuring at various points in the system. The supply should typically read 20 – 25 VAC and the SIOX bus 18 – 35 VDC. During operation, the bus will dip a few volts, since each communication is a mix of the steady DC voltage and zero voltage bits. It is possible to use the spy function of a terminal to verify that communications reach that point.

12.2 Addressing Standard

To make future expansion and troubleshooting easier, the units are addressed in accordance with the following standard.

Terminals:

ST4 terminals are addressed from address 01. If the unit also can control taps, the tap function uses the same address.

I/O-cabinets for taps:

ST4-7 uses addresses from 21 (taps 1 – 7, ST4-2 only taps 1 – 2).

I/O-cabinets for pump operation:

ST4-7 and SD2 are addressed from address 51 upwards.

Tank level measuring:

R02 is addressed from address 57.

Bus extension units:

All R30 are addressed to address 63.

> **NOTE!**
> When systems with more than 20 terminals are assembled, addressing of I/O-cabinets should always begin at address 31.

13 Compatibility with Older Systems

13.1 I/O-devices

Old installations of Safe Record (former version of NMS) use an integrated unit with 7 or 14 valve channels and mains transformer combined in a large cabinet. Normally, if service is needed on such a unit, it should be replaced with an identical cabinet or the exact part of it that has failed. However, since the communication protocol remains the same, it is possible to replace a valve controller unit with an ST4-7 if the physical differences are taken into account.

- The old unit handled 7 or 14 channels so one or two ST4-7 will be needed.
- The one or two addresses in the old I/O-unit must be copied to the ST4-7(s).
- The old unit included a mains transformer, while ST4-7 relies on an external trafo.
- The old unit had terminals to output a rectified 24 VDC to the central PC connector "K32". No such output is available on ST4-7, so a small DC supply 24 V 150 mA must supply the K32, just as is included in the ST4-0 Bus Converter (Chapter 10 Bus Extender R30).
- The override key switch that was placed inside the old I/O-casing is not available in ST4-7, where this function is handled differently (Chapter 11 Key Switch Unit ST4-K).

13.2 Mini Terminals

The Mini Terminal used in old installations was called ST3. It had a limited language capability. The new ST4-T handles most non-standard national characters differently from the ST3, and you can therefore not directly switch between them. Key pressures and Bar Code reading on the other hand is the same.

Contact Nederman for advice.

14 Troubleshooting

Most upcoming problems with an already installed NMS system depends on wiring, unless, of course, some physical damage to a unit has occurred. Therefore, first of all, shall be established that the voltages in various points are correct.

Measure the voltage from each transformer and its connection points at various modules. Inside an ST4-7 or ST4-T, when checking between I/O-screw terminals 2 and 4, shall appear the same voltage as from the transformer, typically 24 VAC. Voltages below some 20 V may cause an output valve to not turn on, while the module itself will still operate and communicate down to some 10 V.

Measure the voltage between the SIOX bus at various points in the installation. The ST4-0 close to the central PC shall generate a DC voltage of 15 to 30 V, polarity is not important. When the PC communicates, the voltage will be lower and fluctuate a little. If a voltage near 0 V is measured, either the ST4-0 supply is missing, or the bus is short-circuited at any point in the installation. In either case, no communications at all can be carried out. In this case, disconnect the bus first near the ST4-0 and alternatively at various points to find out when the voltage reappears.

If the system is communicating properly and only one or more valves will not turn on, the particular output shall be checked by measuring across the output when an order is being executed. The full voltage from the transformer shall appear. Note that the screw heads of the connection points may be oxidized and difficult to make contact with by the measuring points.

15 Spare Parts

⚠ **CAUTION! Risk of equipment damage**
Use only Nederman original spare parts and accessories.

Contact your nearest authorized distributor or Nederman for advice on technical service or if you require help with spare parts. See also www.nederman.com.

15.1 Ordering spare parts

When ordering spare parts always state the following:

- The part number and control number (see the product identification plate).
- Detail number and name of the spare part (see www.nederman.com/en/service/spare-part-search).
- Quantity of the parts required.

16 Recycling

The product has been designed for component materials to be recycled. Different material types must be handled according to relevant local regulations. Contact the distributor or Nederman if uncertainties arise when scrapping the product at the end of its service life.

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