PrediktIR II

PROFINET IO

Industrial Communication Option

Publication Reference : 120/16795-01

Issue A

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Proprietary Notice

PrediktIR II PROFINET IO User's Manual

Part Number: 120/16795-01

Issue: A

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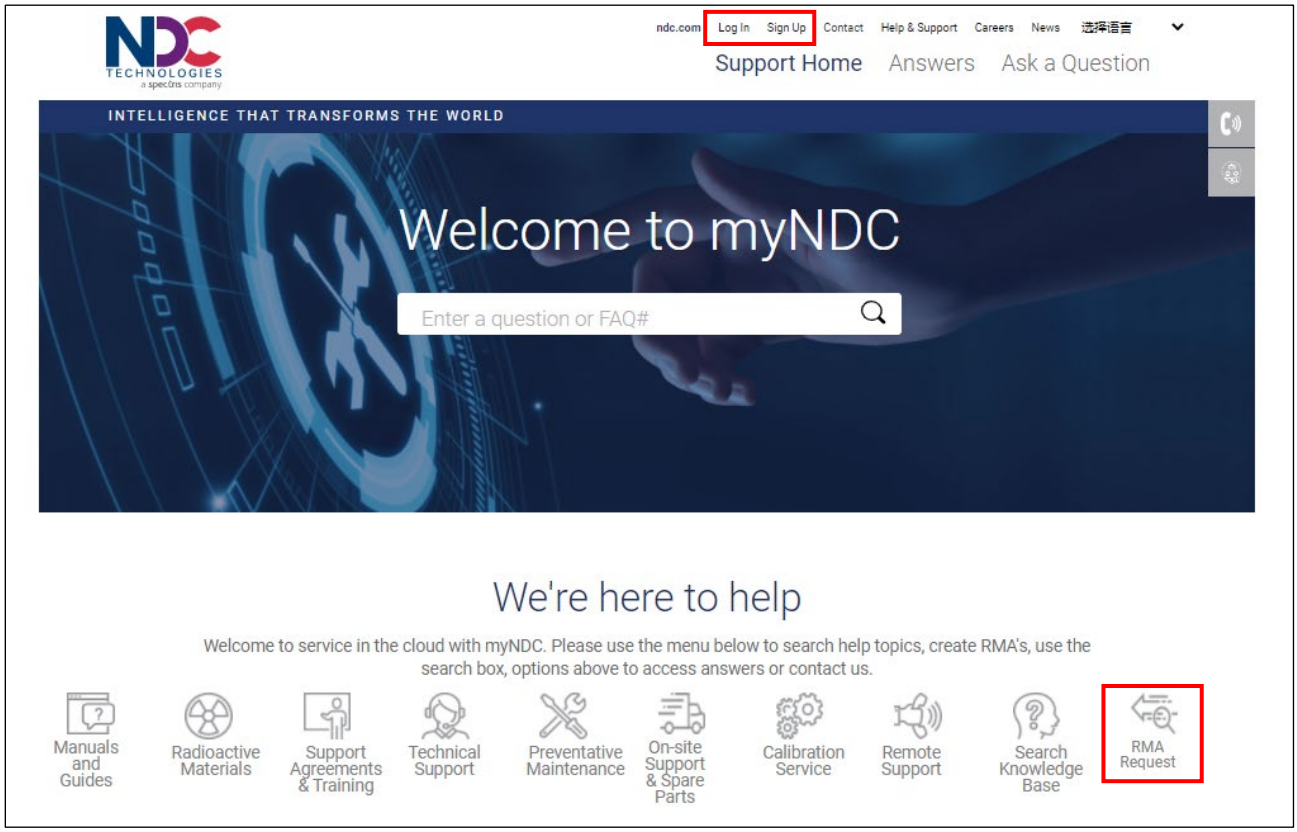
- To create a myNDC account, click **Log In** or **Sign Up**. After creating the account, you will be immediately logged in. To log in on subsequent visits to myNDC, click **Log In**, enter your user name and password, and then click **LOG IN**.

- To submit an RMA, click on **RMA Request** and follow the on-screen instructions.



NDC Contact Numbers

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Americas	+1 626 939 3855
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Japan	+81 (0)3 3255 8157
China	+86 21 61133609
EMEA (Europe, Middle East, Africa)	Germany: 0800 1123194
	Italy: +39 0331 454 207
	All other countries (English speaking): +44 1621 852244 Please select option 2 to be connected to the service team

Caution

- **The equipment described in this manual contains high potential voltages. Isolate the mains supply from the equipment during interconnection and maintenance.**
- **If the gauge is not installed and used in the manner prescribed in this manual, the safety protection afforded by the equipment may be impaired.**
- **For complete electrical safety in operation, the equipment has been supplied with double-pole neutral fusing incorporated. Do not modify in any way.**

Storage & Unpacking

Storage

Pending installation, store between 0°C and 70°C at less than 60% relative humidity. Allow the equipment to regain ambient temperature prior to installation.

Unpacking

Note: Before unpacking your on-line gauge, make sure you check off all the items against the packing list.

Retain the packaging used to ship all parts of your system, so that in the event that the equipment needs to be returned, it can be suitably re-packed for its safe return.

Open the packaging carefully and remove each item. Take the items to a clean room for inspection. Check that all the items on the Packing Note / Scope of Supply, have been supplied. Check that they are free from external damage, the connectors are free from dirt, and the cables are not chaffed or kinked.

Table of Contents

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CHAPTER 1

1 Introduction

The following supplement should be read in conjunction with the PrediktIR II User guide to ensure a reasonable level of familiarity with the gauge.

The PROFINET IO option enables the PrediktIR II gauge to be a slave device on a PROFINET network, allowing gauge data such as the real time measurement values, calibration parameters, gauge status and diagnostics to be read and written from a PROFINET master.

Note that the PROFINET IO communication stack runs inside the PrediktIR II gauge and is enabled as part of the factory configuration. It can also be enabled in the field as a purchased option, with assistance from our Customer Care representatives.

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CHAPTER 2

2 PROFINET IO Implementation

The PrediktIR II Gauge implements a PROFINET IO Device with the following capabilities:

- Cyclic (RT Class 1)
- 1 AR
- 1 Input CR
- 1 Output CR
- 1 Alarm CR
- **Cycle Time** (interval between two parameter value updates):

  New measurement data from hardware: 32 ms
- **General**:
  - Processing DCP requests
  - Processing RPC requests
  - DHCP supported
  - PROFINET specification V2.3

Further implementation details may be found in the PROFINET IO GSDML file.

The Device name, Initial IP address, and other settings may be altered using Profinet supervisor programs such as Proneta or Profinet Commander.

The PrediktIR II Gauge is not certified by PROFINET International as a PROFINET IO Device; however, it is targeted at **Conformance Class A**.

The PrediktIR II Gauge is tested with de-facto industrial standard Siemens PLCs (CPU 315-2, CPU 317-2, CPU 414-2, CPU 416-2, CPU 1212, Software PLC) using the configuration software STEP7 5.4.

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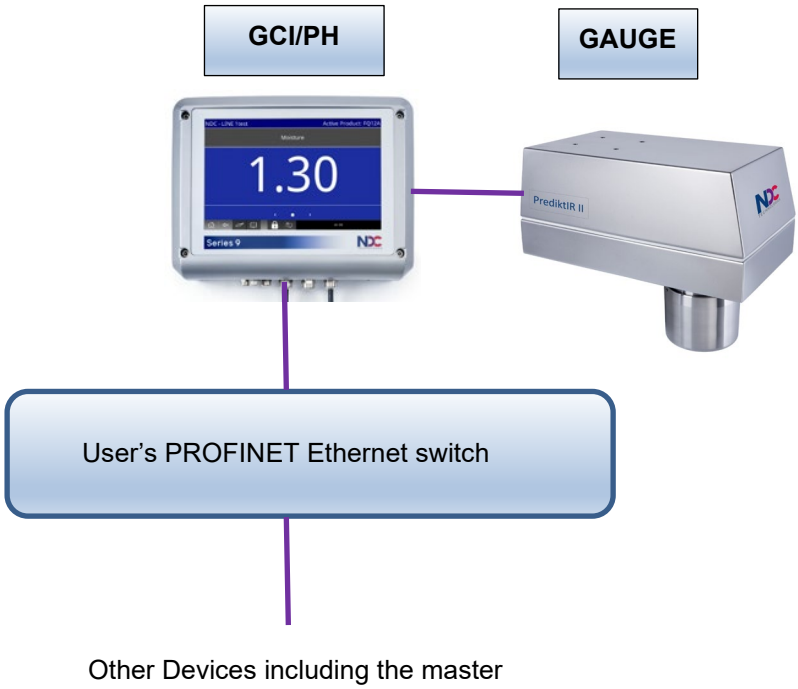
CHAPTER 3

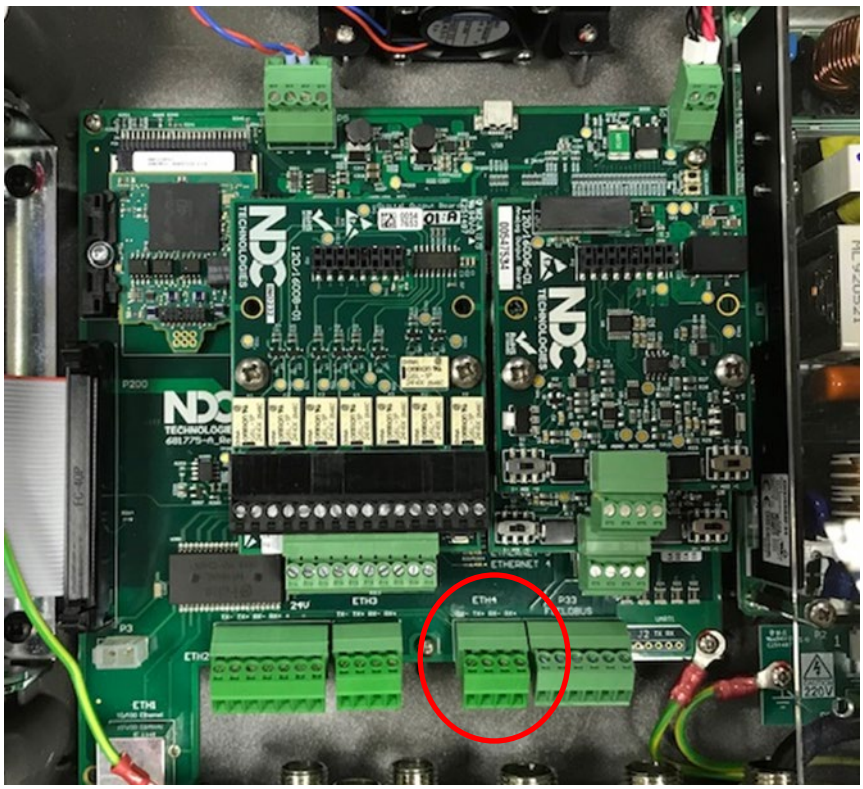
3 Physical Connection

The PROFINET connection is made through one of the following two peripherals that is connected to the gauge:

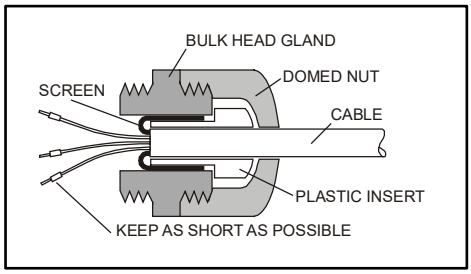
- Gauge Control Interface (GCI)
- Power Hub (PH)



The PROFINET connection point is the same in all the units - through a screw termination block marked ETH4, as circled in red in the photo below.



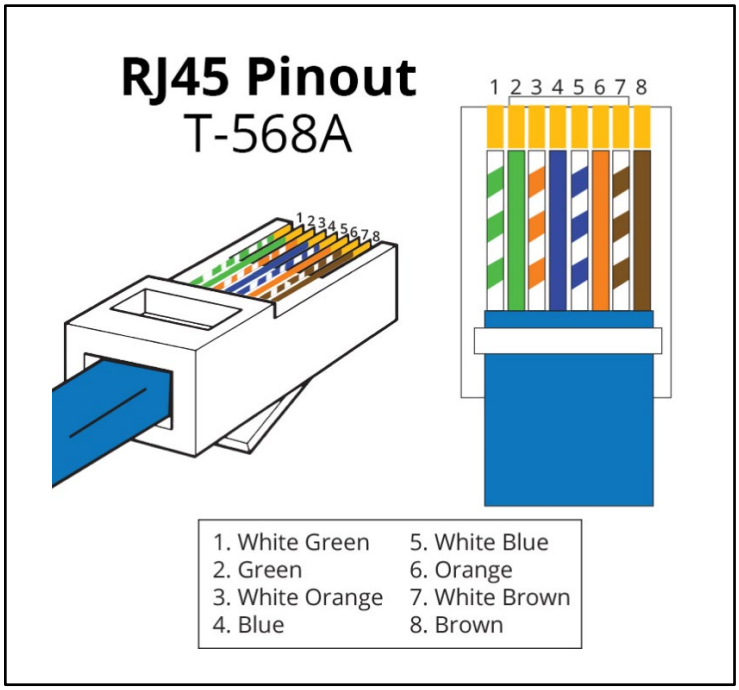
Only Cat5e or Cat6 twisted pair cable should be used, with the screen terminated to the metal gland as depicted below.



The signal terminations are as follows:

4 way	Name	Wire Colour
1	Tx-	White Green
2	Tx+	Green
3	Rx-	White Orange
4	Rx+	Orange

For reference, the RJ45 connector wire colours are shown below.



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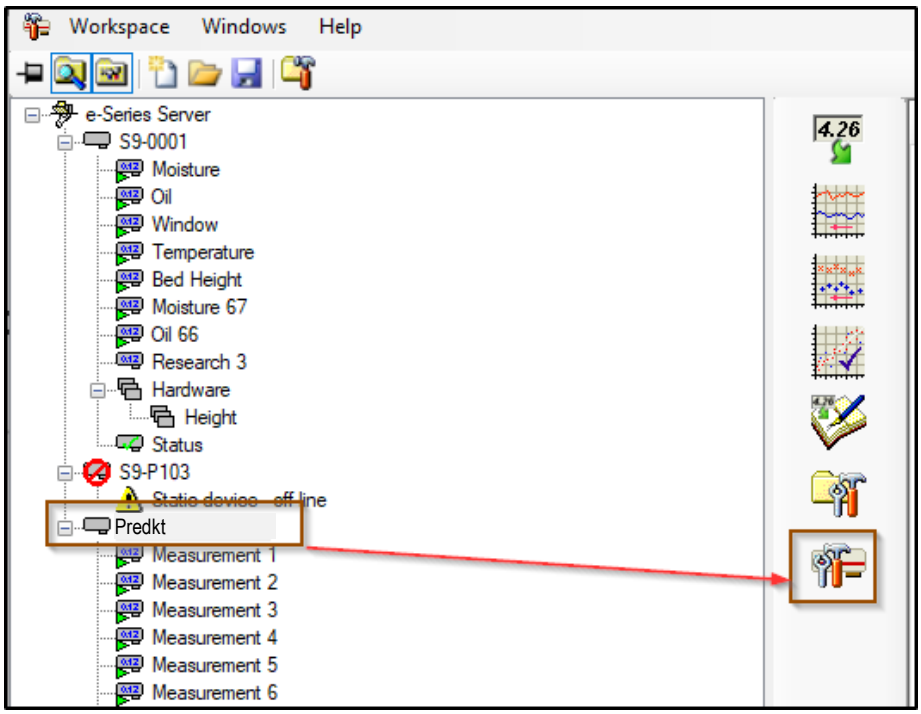
CHAPTER 4

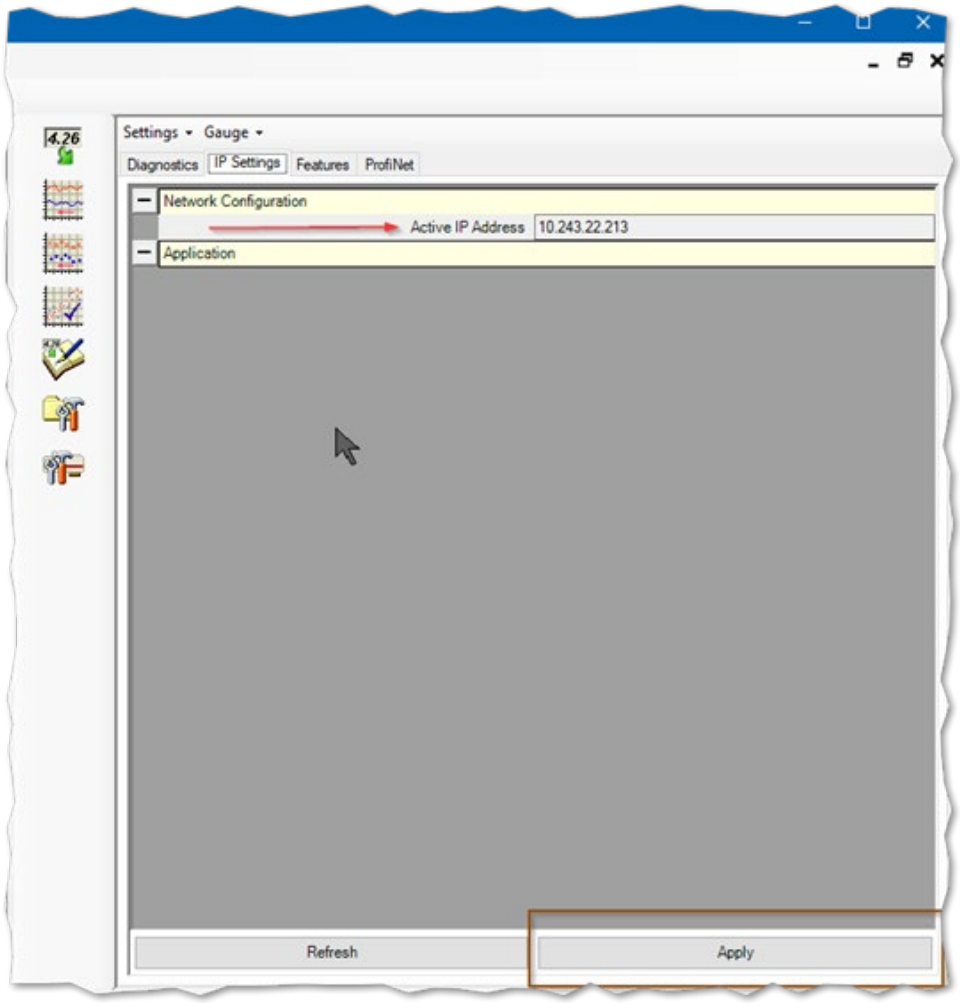
4 IP Address Settings

The PREDIKTIR IP address can be confirmed or changed through **GaugeToolsXL** as follows:

1. Start **GaugeToolsXL** and drag the Gauge node to the “Gauge Utility” icon.



2. Select the **IP Settings** tab and enter the required values.



3. Click **Apply** to use the new settings.

The host computer's original settings may now be re-applied.

The **ProfiNet** IP settings need to be applied using a ProfiNet supervisor program. See Section 4.1 - Using Profinet Supervisor programs.

Note: Each IP address on the network should be unique - if an IP conflict is found, it will be impossible to connect to the Gauge via GaugeToolsXL.

4.1 Using Profinet Supervisor programs

Profinet supervisor programs are another way of setting the Device name and IP settings of a Profinet enabled gauge. Two free programs are:

- Proneta
- Profinet Commander

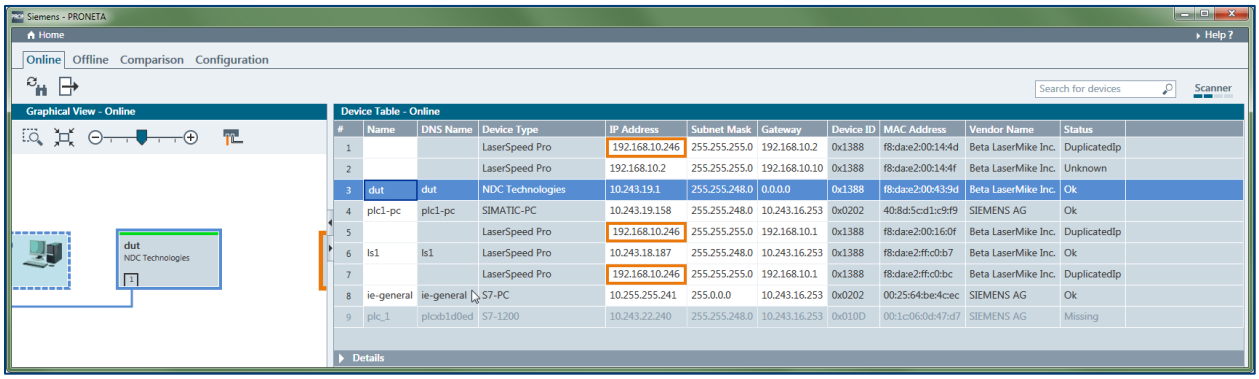
Note: When using the gauge's ProfiNet communications interface for the first time, the Device name will be blank and the IP settings will be zero (ip address = 0.0.0.0, network mask = 0.0.0.0). Those parameters must be set to valid values before trying to connect to a PLC.

4.1.1 Proneta

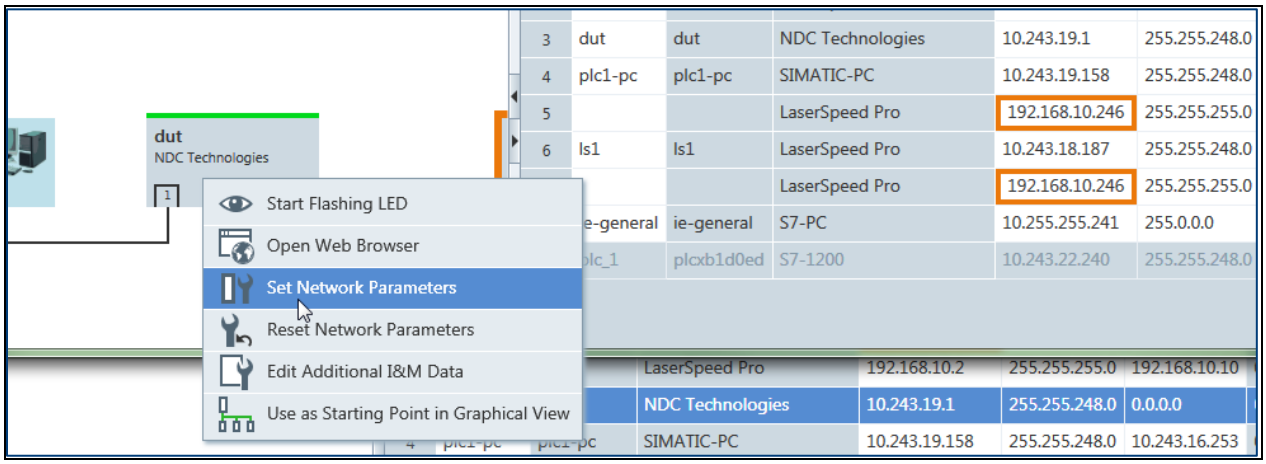
Proneta is available for download from:
https://new.siemens.com/global/en/products/automation/industrial-communication/profinet/portfolio/proneta.html

Proneta will scan the network it is attached to and report all Profinet enabled devices it finds. To change the Device name or ip settings of a particular device:

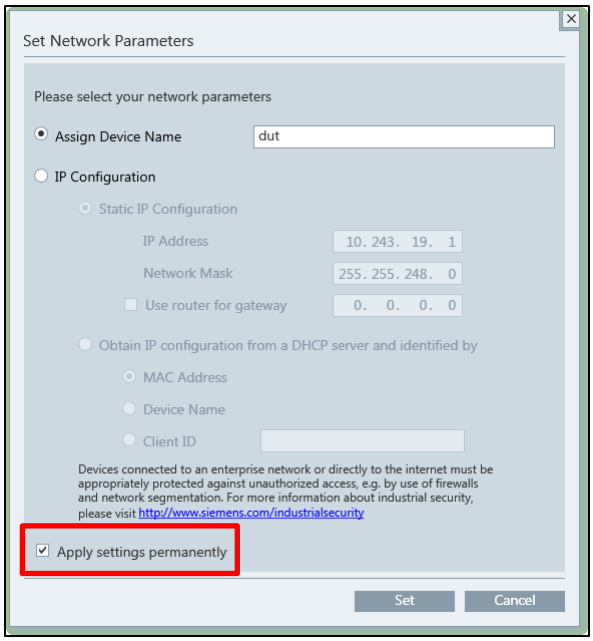
1. Select the device from the Device table.



2. Right-click to get the pop up window and select **Set Network Parameters**.

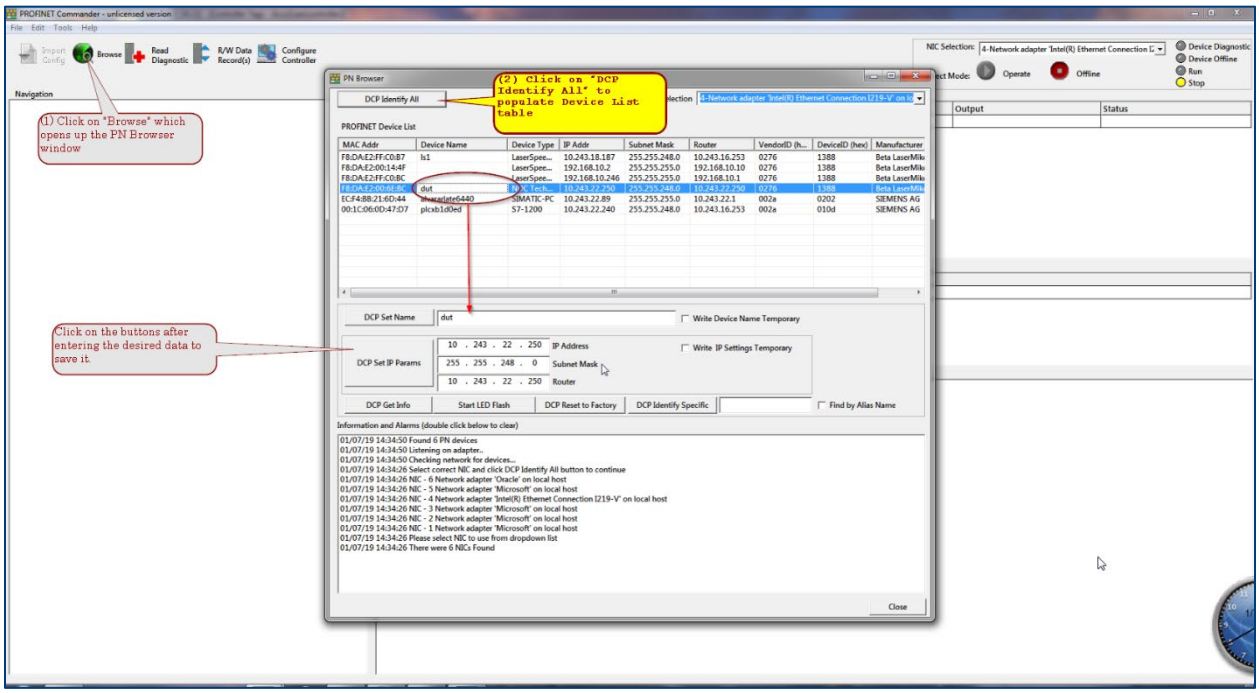


3. From the Set Network Parameters pop up window, you can change the device name and ip settings.
4. Be sure to check the **Apply settings permanently** box.



4.1.2 Profinet Commander

Profinet Commander is available for download from: https://profinetcommander.com/



Once the ProfiNet settings have been changed, the gauge should be reset.

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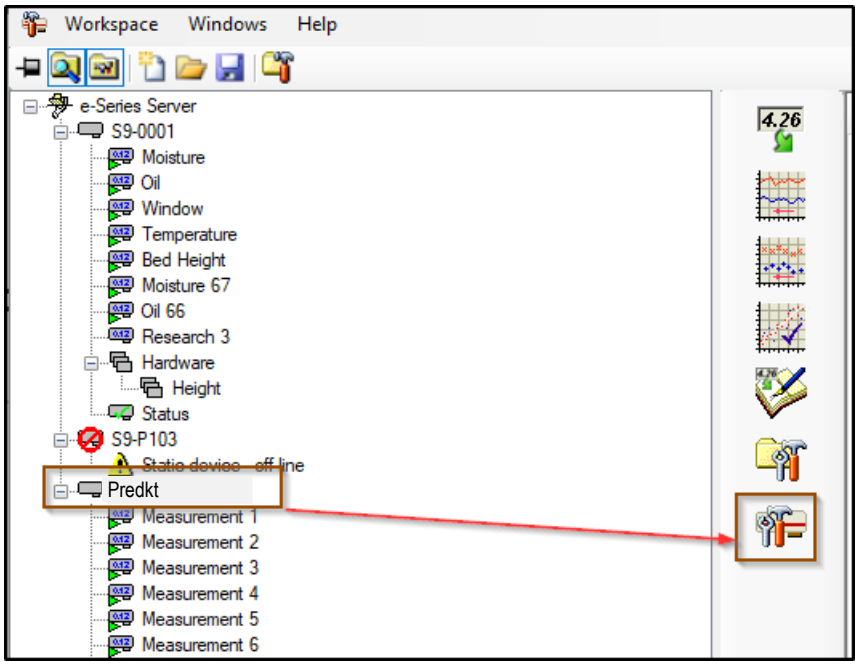
CHAPTER
5

5 Selecting Protocol Parameters

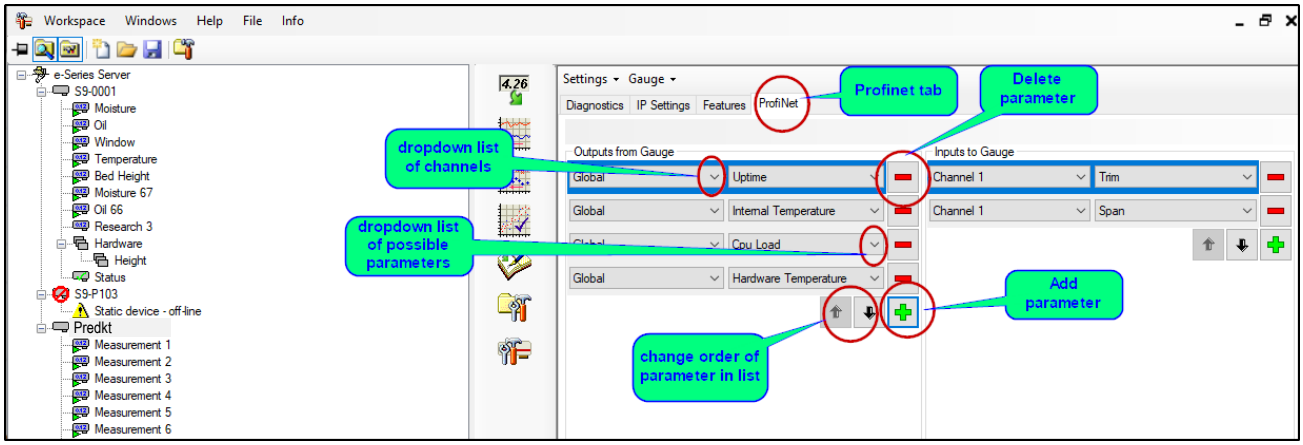
This chapter describes how the GaugeToolsXL utility allows the user to change the order of the Protocol parameters, to add or delete parameters, and to upload the changes to the gauge.

The GaugeToolsXL User's Manual details the installation and operation of the GaugeToolsXL software package.

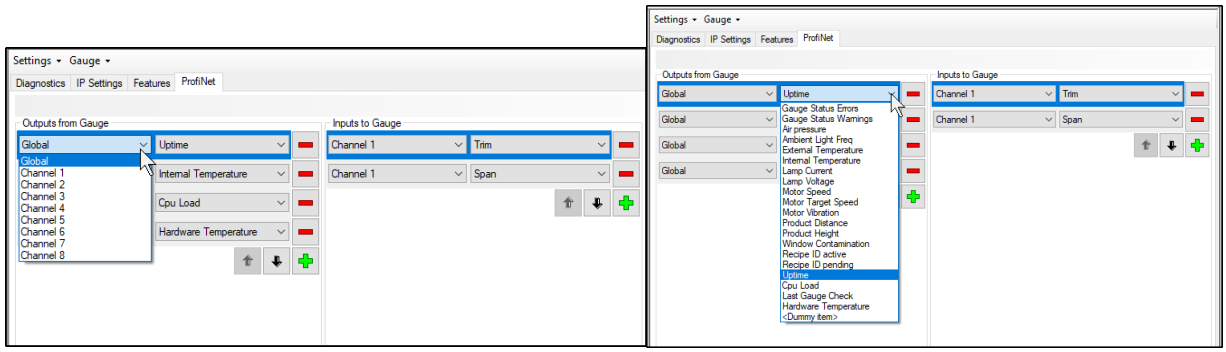
1. Start GaugeToolsXL and drag the Gauge node to the "Gauge Utility" icon.



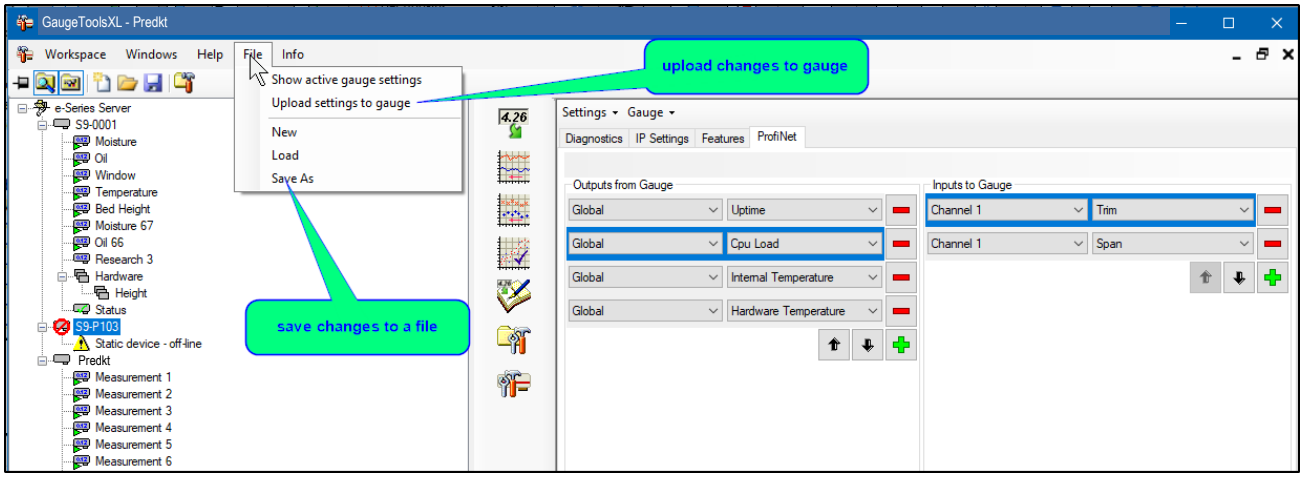
2. Click on the “ProfiNet” tab.



3. Add or remove parameters by clicking on the + or − buttons, or use the drop down boxes to select the parameters.

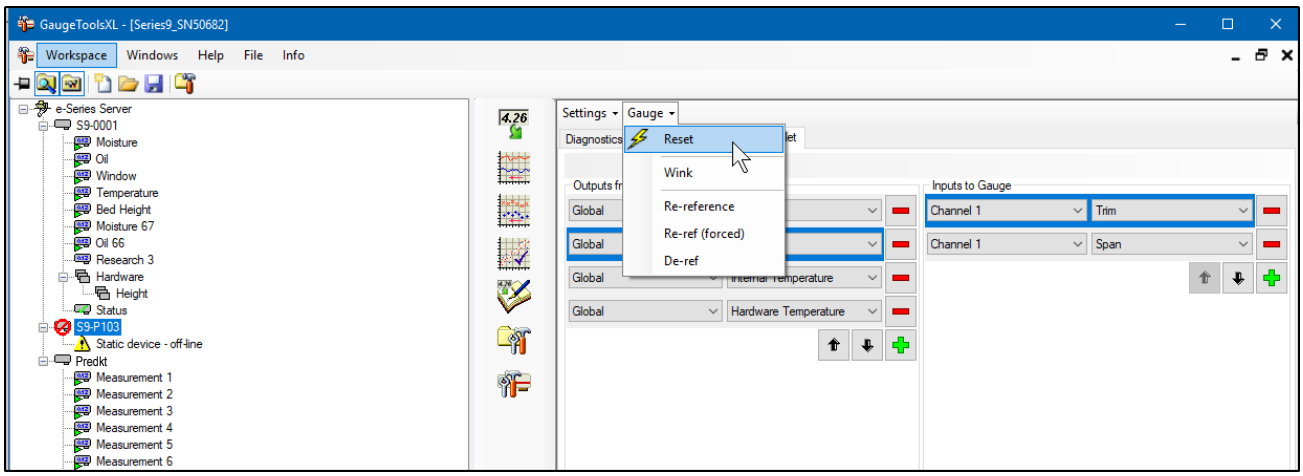


4. Once the desired changes have been made, it is possible to upload the changes to the gauge or save the changes to a file.



5. When uploading the changes to the gauge, the GaugeToolsXL utility will show a status message.

6. After the changes are uploaded, the gauge needs to be reset for them to take effect.



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CHAPTER 6

6 GSDML File

The GSDML file is applicable to all types of PrediktIR II Gauges, as it is not reliant on the physical Gauge configuration. It can be downloaded from NDC Service Cloud at https://ndc.custhelp.com.

Note: Although the GSDML file doesn't change too often, whenever the firmware is updated in the gauge, check if there is a newer GSDML file too.

Example GSDML file name:

*GSDML-V2.35-NDCTechnologies-PREDIKTIRFamily-**20200604**.xml*

where the last tag indicates the date of the creation.

Per the GSDML file:

- The default device name is "ndctech".
- The data model is 128 bytes in and 128 bytes out. If fewer parameters are required, the data located in the unused area will be ignored.
- The minimum interval between exchange (update time) of IO data is 32ms.

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CHAPTER 7

7 Data Parameters

The default register assignments for ProfiNet IO are given in the table below.

All parameter data is 32-bit and occupies 2 addresses per value.

PLC Inputs (Outputs from the gauge)

Buffer Index	Name	Type	Description
0	Gauge Status	Unsigned 32 bit integer	Gauge Status[1]
4	Gauge Warnings	Unsigned 32 bit integer	Gauge Warnings[2]
8	Channel 1 Output	32 bit Float	The Units of the measured value depend on the target material and the application (e.g. moisture [%]).
12	Channel 2 Output	32 bit Float	The Units of the measured value depend on the target material and the application (e.g. moisture [%]).
16	Channel 3 Output	32 bit Float	The Units of the measured value depend on the target material and the application (e.g. moisture [%]).
20	Channel 4 Output	32 bit Float	The Units of the measured value depend on the target material and the application (e.g. moisture [%]).

[1]**Note:** **Status Output** is a bit-encoded word

Bit 0: STATUS_BIT_MOTOR: Fault with main filter wheel motor

Bit 1: STATUS_BIT_LAMP: Lamp error

Bit 2: STATUS_BIT_SIGNAL_LOW: Light signals received by gauge are too low to make a good reading

Bit 3: STATUS_BIT_SIGNAL_HIGH: Light signals received by gauge are too high to make a good reading

Bit 4: STATUS_BIT_WINDOW: Window is contaminated, error threshold of 1.0 reached

Bit 5: STATUS_BIT_TEMPERATURE: The internal temperature of the gauge has exceeded the error level. Can also be triggered for a low temperature error (i.e. gauge is too cold to operate correctly)

Bit 6: STATUS_BIT_INTERNALREF: The internal reference system has failed

Bit 7: STATUS_BIT_VOLTAGE: A bad voltage has been detected on one of the PCBs

Bit 8: STATUS_BIT_SLAVEHEAD: Unable to access slave head (only applies to double-headed gauges like the Haze gauge)

Bit 9: STATUS_BIT_AIRFLOW: The air pressure is out of range, suggesting air flow to the air purge is incorrect

Bit 10: STATUS_BIT_SYNCPULSE: Unable to detect the synchronisation pulse (only applies to double-headed gauges like the Haze gauge)

Bit 11: STATUS_BIT_AUTOSAMPLER: Auto sampler system has failed (only applies to gauges with PowderVision sampling enabled)

Bit 16: STATUS_BIT_SELF_TEST: General hardware error detected at start up

[2]**Note:** **Status Warnings** is a bit-encoded word

Bit 4: STATUS_BIT_WINDOW: Window is contaminated, warning threshold of 0.60 reached

Bit 5: STATUS_BIT_TEMPERATURE: The internal temperature of the gauge has exceeded the warning level. Can also be triggered for a low temperature warning (i.e. gauge is too cold to operate correctly)

PLC Outputs (Inputs to the gauge)

Buffer Index	Name	Type	Description
0	Channel 1 span	32 bit Float	Multiplier factor for the Output: Output = (Span * X) + Trim (Where X is the raw measurement value)
4	Channel 1 trim	32 bit Float	Offset for the output: Output = (Span * X) + Trim (Where X is the raw measurement value)
8	Channel 1 Application code	Unsigned 32 bit integer	Current application code value for this channel
12	Channel 2 span	32 bit Float	Multiplier factor for the Output: Output = (Span * X) + Trim (Where X is the raw measurement value)
16	Channel 2 trim	32 bit Float	Offset for the output: Output = (Span * X) + Trim (Where X is the raw measurement value)
20	Channel 2 Application code	Unsigned 32 bit integer	Current application code value for this channel
24	Channel 3 span	32 bit Float	Multiplier factor for the Output: Output = (Span * X) + Trim (Where X is the raw measurement value)
28	Channel 3 trim	32 bit Float	Offset for the output: Output = (Span * X) + Trim (Where X is the raw measurement value)
32	Channel 3 Application code	Unsigned 32 bit integer	Current application code value for this channel
36	Channel 4 span	32 bit Float	Multiplier factor for the Output: Output = (Span * X) + Trim (Where X is the raw measurement value)
40	Channel 4 trim	32 bit Float	Offset for the output: Output = (Span * X) + Trim (Where X is the raw measurement value)
44	Channel 4 Application code	Unsigned 32 bit integer	Current application code value for this channel

Note: If a parameter configuration is desired that is different from the default, it can be done with assistance from our Customer Care representatives.

7.1 Parameters

- **Output** (read only)

  Measurement value of the specified channel.

  The Units of the measured value depend on the target material and the application (e.g. moisture [%]).

- **Span**

  Multiplier factor for the output: **Output = (Span * X) + Trim**

  (where **X** is the raw measurement value).

  This parameter is available for all measurements, including temperature.

- **Trim**

  Offset for the output: **Output = (Span * X) + Trim**

  (where **X** is the raw measurement value).

  This parameter is available for all measurements, including temperature.

- **Application Code**

  This 32-bit integer code is used to select the appropriate algorithm in the gauge for the intended measurement - consult NDC for a list of codes that can be used with the specific gauge.

  Note: An application code of zero will disable the channel measurements.

- **Application Code Full**

  This always reflects the full application code, regardless of how the application is selected in Application Code above.

- **Response Time**

  Output smoothing using an exponential factor [0…3600].

- **Lamp Current [A]** (read only)

  Current through the lamp.

- **Lamp Voltage [V]** (read only)

  Voltage across the lamp.

- **Motor Speed [rpm]** (read only)

  The current speed of the Filter Wheel (motor) in the gauge.

- **Motor Target Speed [rpm]** (read only)

  The desired speed of the Filter Wheel (motor) in the gauge.

- **Motor vibration** (read only)

  Vibration near the filter wheel motor in raw units.

- **Internal Temperature [degC]** (read only)

  The internal temperature of the gauge. This is typically 15 to 20ºC above the external temperature, and will slowly track any changes in the ambient.

- **External Temperature [degC]** (read only)

  The Product (target material) temperature.
  This is only available on Gauges fitted with an external temperature sensor.

- **Window Contamination** (read only)

  The Window Contamination level as seen by the user.

  (A clean window will be close to zero and a dirty window >0.5.)

- **Air flow monitor** (if option fitted)

  The air flow to the Air Purge Window in Liters per minute.

- **CPU load** (read only)

  The current % workload of the gauge embedded computer, which should on average be no more than 50%.

- **CPU Uptime** (read only)

  The time in seconds since the last CPU reset.

- **Gauge Status** (read only)

  Bit encoded 32-bit word of status condition. See bit definitions above.

- **Gauge Warnings** (read only)

  Bit encoded 32-bit word of warning condition. See bit definitions above.

- **Active Recipe index** (read only)

  Uint32 value of the currently loaded recipe index.

- **Pending Recipe index** (write only)

  Uint32 value of the recipe index that will be loaded when written.

- **Product Distance** (write only)

- **Product Height** (write only)

7.2 Data Formats

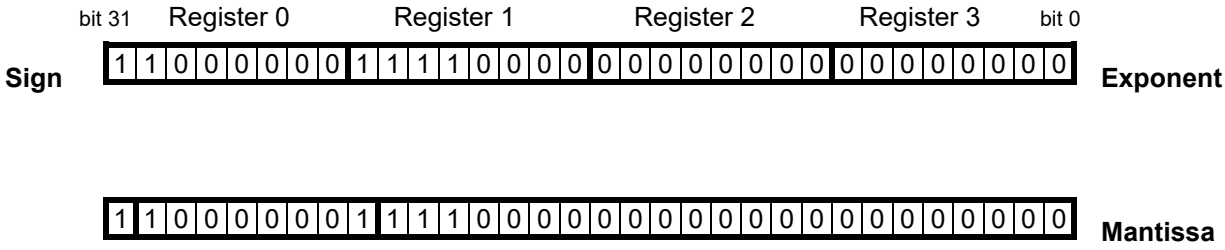
7.2.1 Real (Floating Point)

Values are presented in IEEE 754 single precision format.

- **Bits 0 to 22** Normalised binary mantissa minus 1
- **Bits 23 to 30** Exponent in unsigned, 8 bit, excess 127 format
- **Bit 31** Sign bit

Example

The example below shows the register contents of a Parameter containing a floating-point value of -7.5, and the corresponding bit assignments for IEEE 754.



The mantissa is $1 + [2^{-1} + 2^{-2} + 2^{-3}] = 1.875$
(as the normalized mantissa is always between 1 and 2, the 1 does not need to be stored)

The value is given by the formula:

$$-\ \text{sign} \times \text{mantissa} \times 2^{(\text{exp} - 127)}$$

which in this case is:

$$-1 \times 1.875 \times 2^{(129 - 127)} \quad = \quad -1.875 \times 2^{2}$$

7.2.2 Long Integer

Values are presented as a 32-bit signed Integer, and are used to convey values which could have a range greater than ± 32768.

Bit 31 is the sign bit. Negative values are in two’s complement format.

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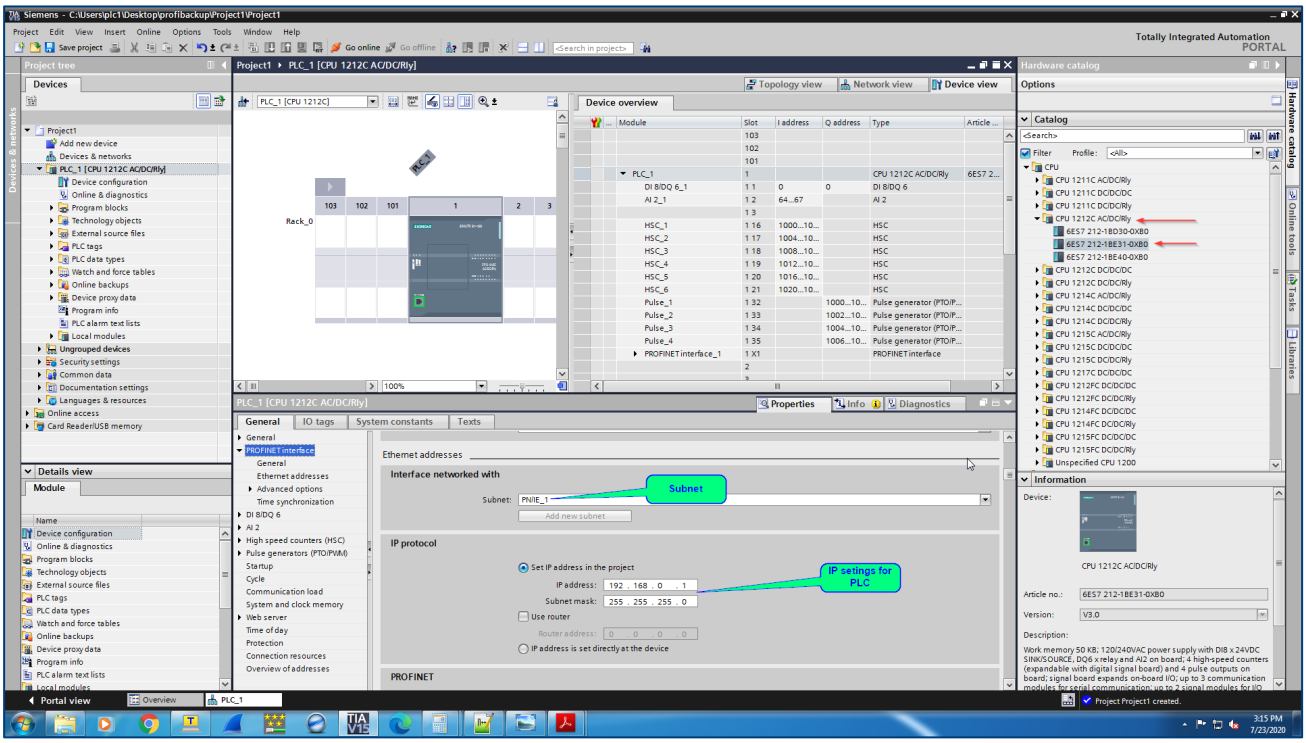
CHAPTER 8

8 Simatic Step 7 (TIA Portal)

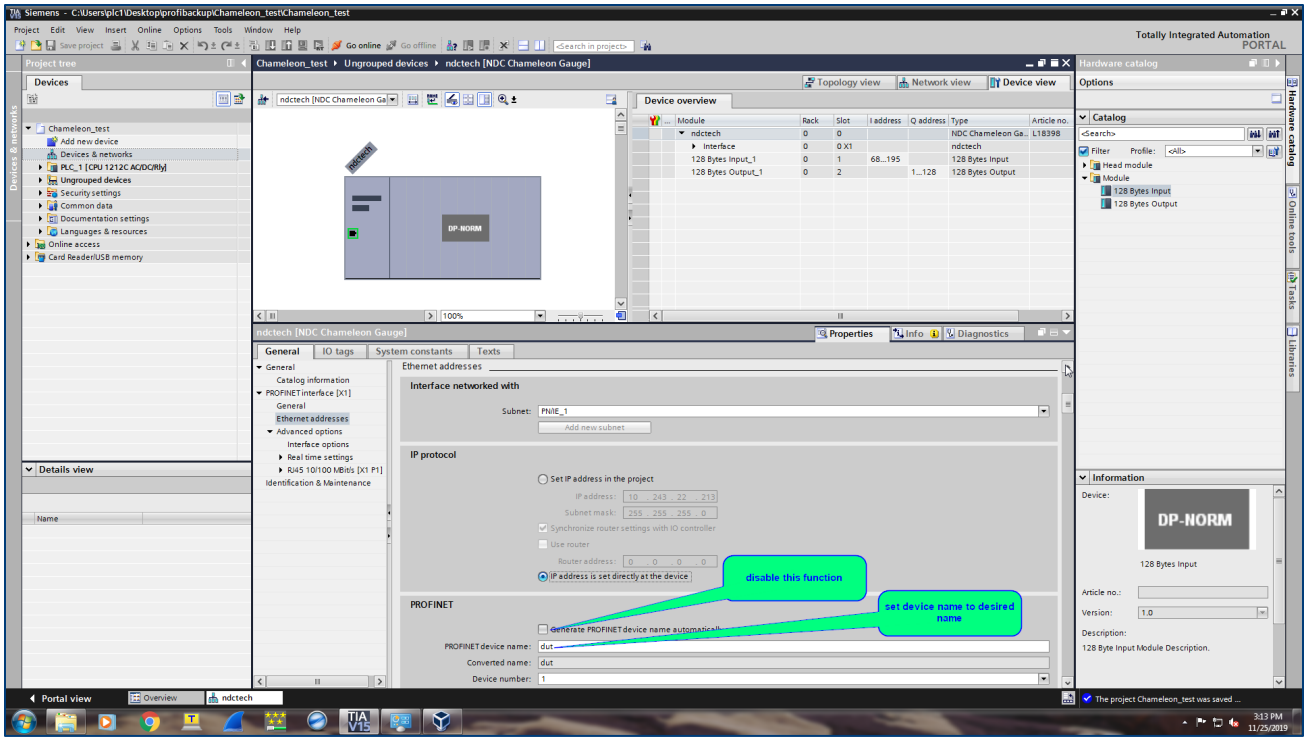
This chapter describes how to add the PrediktIR II gauge to a PROFINET project. The starting point is an existing S7 project, which is set up for PROFINET network and contains at least one configured PLC.

Open the project and go to **Devices & networks**. The following screenshot has been configured with a PLC 1212C AC/DC/Rly and has had a PROFINET IO system inserted. Use a correct configuration for your hardware.



8.1 PROFINET Device Name

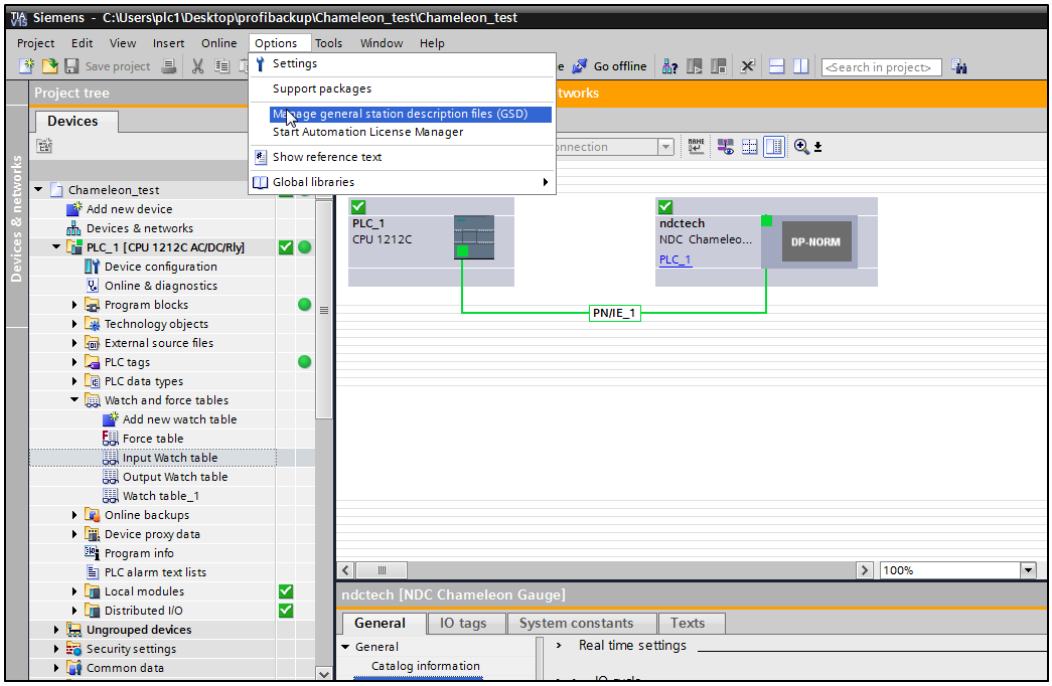
IMPORTANT: PROFINET uses lowercase names!
Always use a name that comprises lowercase alpha/numeric characters.



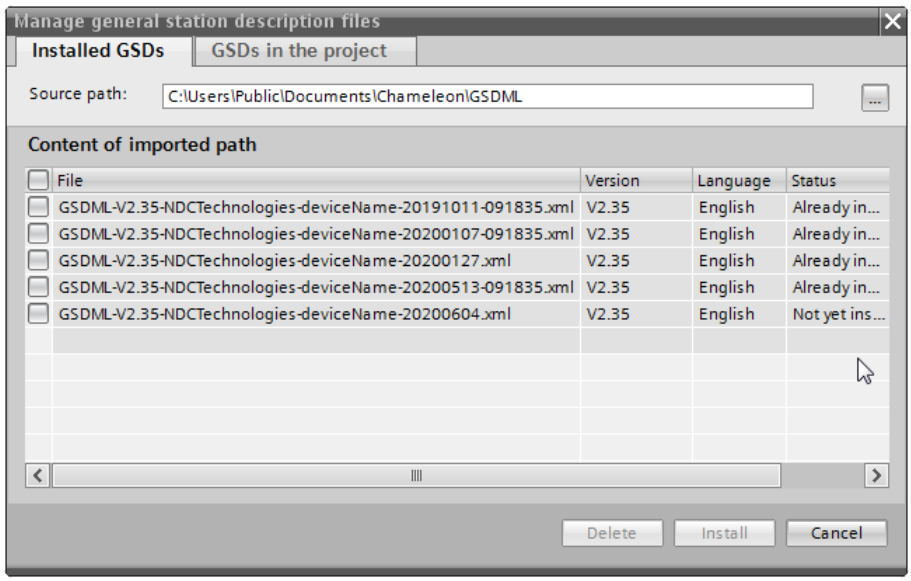
To use the Device name specified in the GSDML file, enable the **Generate PROFINET device name automatically** box. Alternatively, to use a different name, disable the automatic naming function and enter the desired name in the **PROFINET device name** line.

8.2 Install GSDML File

Choose menu **Options > Manage general station description files (GSD).**



Select the GSDML file provided for PrediktIR II Gauge and **Install**.



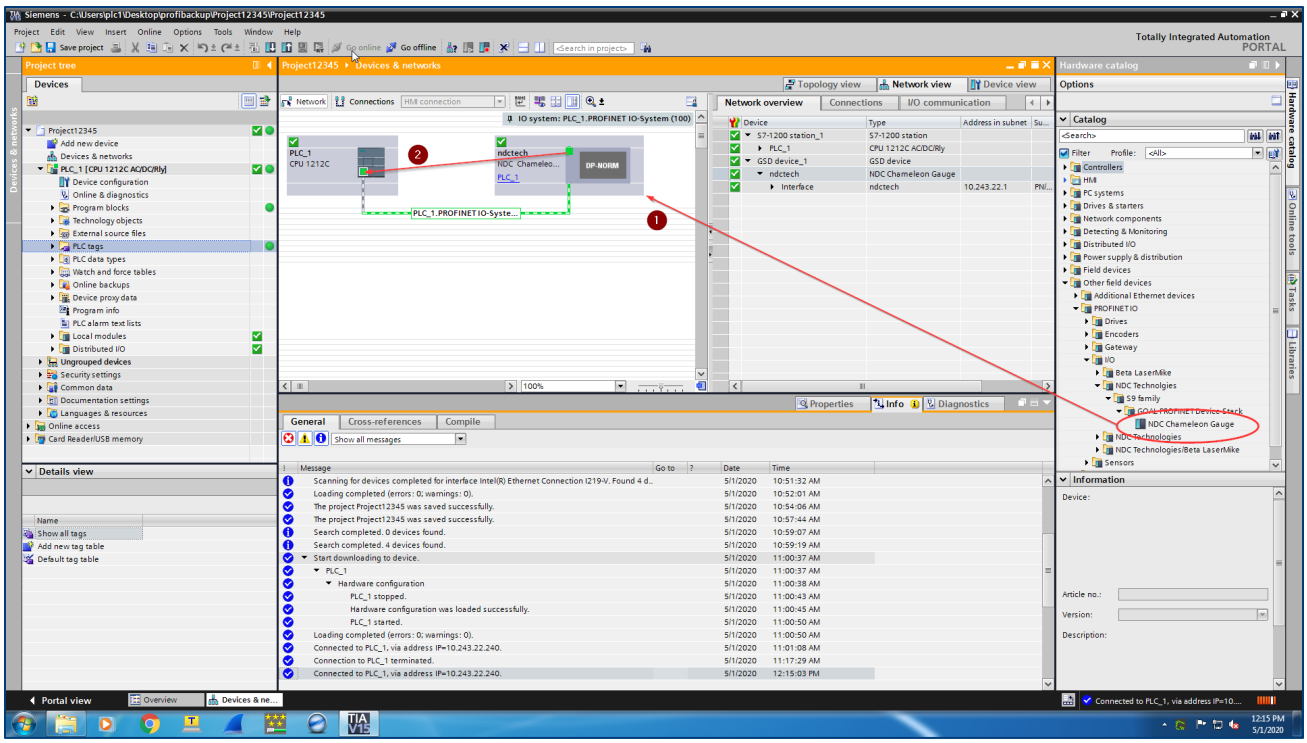
8.3 Add Gauge

In the hardware catalog, browse for the device “**NDC Chameleon Gauge**” described in the previously installed GSDML file.

1. Drag and drop to the Network view window.

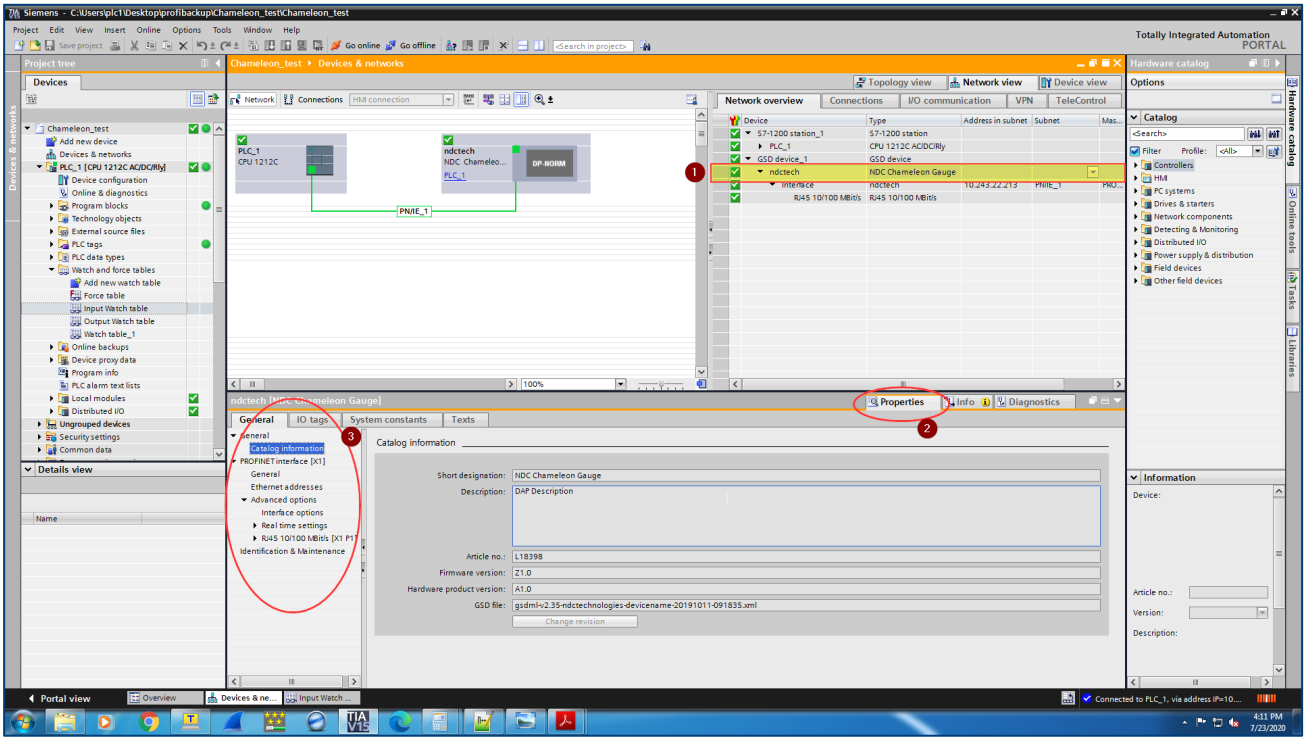
2. Drag the line from the “NDC Chameleon Gauge” green block to the “PLC_1” green block to connect to the PROFINET network.

It creates an object for the gauge instance.

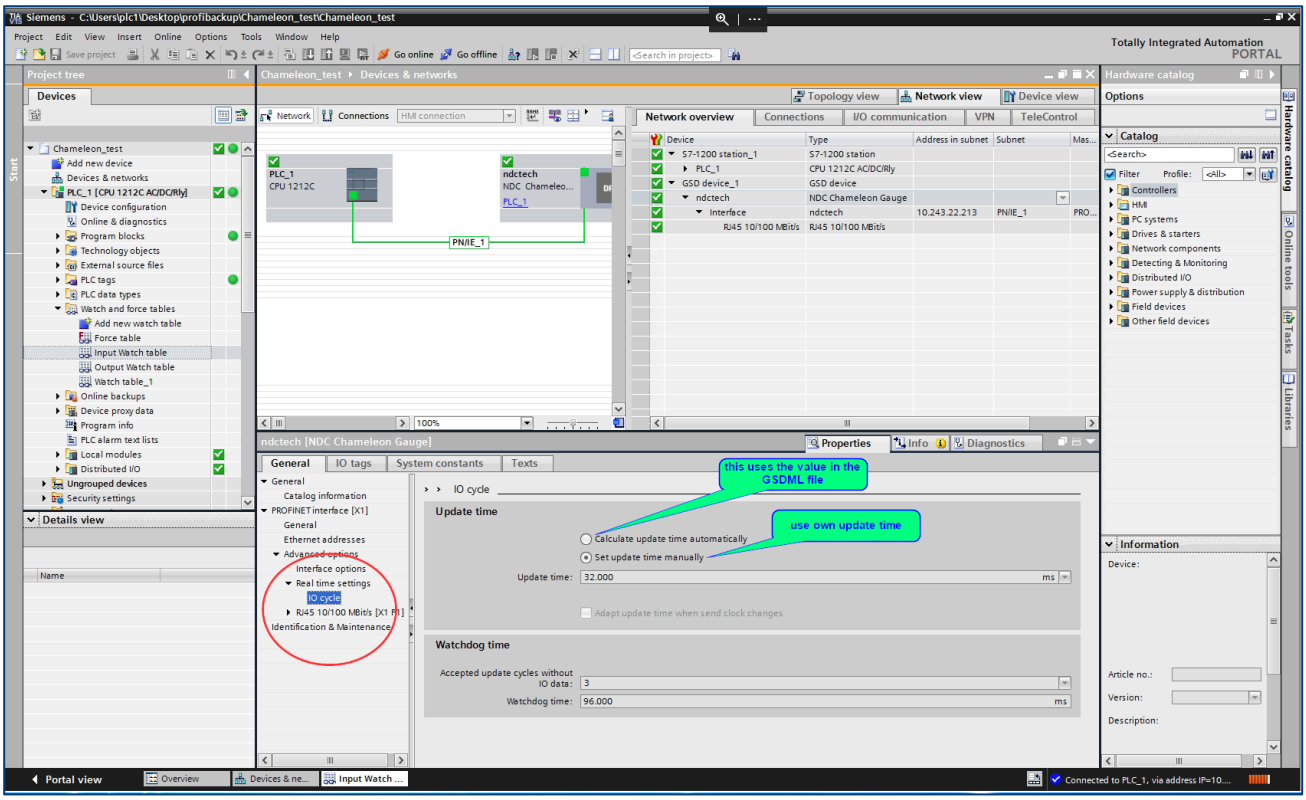


8.4 Gauge Properties

1. Select NDC Chameleon Gauge.
2. Select the **Properties** tab.
3. Select the property to be seen.



4. Switch to the **IO cycle** property.



Now the project is configured for the PrediktIR II gauge! Don't forget to **Save** and **Compile…** and **Download** to the PLC.

Warranty

1. All sales of NDC Technologies products are subject to the contractual terms and conditions of the Order pursuant to which they were sold to Buyer, including Warranty terms. The following terms are a general summary of the contractual Warranty terms, NOT a revision or alternative to the contractual terms, and are presented as merely a point of reference for your information. The contractual Warranty is the complete and exclusive statement of all NDC Technologies warranties to Buyer. In the event the following terms are in conflict with any of the contractual Warranty terms, the contractual Warranty terms shall be deemed to control.

   The warranty terms contained herein are expressly in lieu of any and all other warranties, expressed or implied, including any warranty of merchantability or fitness for a particular purpose. In no event shall NDC Technologies be liable for any incidental, consequential or special damages, including but not limited to, any loss of business, income or profits, expenses incurred for time when the system is not in operation, and any labor costs relating to or arising out of the performance, functioning or use of the system.

   Purchaser assumes the risk for use of this product and agrees to indemnify and hold NDC Technologies harmless for any and all damage to person or to property resulting therefrom.

   NDC Technologies grants no license under any patent rights except the right, under only such patents as may be owned or acquired by NDC Technologies, to use the product sold hereby for the purpose for which it is sold. NDC Technologies does not warrant that the product or its use does not infringe any patent owned by persons other than NDC Technologies.

2. NDC Technologies guarantees all products to be free from defects in material and workmanship for the following periods[1]:

   - Product and peripherals – 2 years from shipment
   - Source lamp – 5 years from shipment
   - Filter wheel motor – 5 years from shipment
   - Spare parts – 1 year from shipment
   - Replacement lamps and motors supplied under warranty – 1 year or up to the original 5 year warranty from shipment of the sensor, whichever is longer

   [1] Refer to the contractual terms and conditions of the Order for usage of the warranty.

   During this period, NDC Technologies will repair or at its option replace, free of all charges for parts and labor, any NDC Technologies parts determined by it to have been broken or damaged due to causes other than improper application, abuse or negligence. NDC Technologies' obligation to repair or replace shall not extend to expendable parts which are subject to normal operating wear.

   Nothing in this paragraph 2 will require NDC Technologies to make repairs or replacements where:

A. The product has been repaired, other than by an authorized NDC Technologies dealer or an NDC Technologies employee, or altered in any way without the prior written consent of NDC Technologies; or

B. The product has not been properly maintained in accordance with any operating and maintenance manual supplied therewith; or

C. The product has been damaged as a result of fire, flood, war, insurrection, civil commotion, acts of God or any other cause beyond the control of NDC Technologies or Buyer.

3. NDC Technologies' liability shall be limited to the obligations set forth in Paragraph 2. These shall be the Buyer's sole and exclusive remedies, whether in contract, tort or otherwise, provided, however, that in lieu thereof, NDC Technologies at its option may replace the entire product on an exchange basis or refund the purchase price against the return of the defective product.

4. NDC Technologies will not be responsible for failure to provide service or parts due to shortage of materials, labor or transportation strikes or delays, or any causes beyond NDC Technologies' control.

5. Unless otherwise specified by NDC Technologies, all warranty repairs will be made at NDC Technologies' facility. The customer shall be responsible for all expenses of packing, freight and insurance in connection with the shipment of products to NDC Technologies for repair. NDC Technologies will pay the cost of returning the equipment to customer.

   If it is mutually determined by the buyer and NDC Technologies that the examination, replacement or repair takes place at the buyer's facility, then the buyer will be responsible for NDC Technologies' travel and living expenses incurred in traveling to and from the buyer's facility, and during the time of the visit, as well as the cost of field labor and replacement parts unless the parts being repaired or replaced are determined to have been defective, in which event the cost of said repaired or replacement parts shall be borne by NDC Technologies. These travel and living expenses will be billed to the buyer at actual cost to NDC Technologies.

6. No person, including any NDC Technologies distributor, agent or representative, is authorized to assume any liability on behalf or in the name of NDC Technologies, and NDC Technologies shall not be bound to any understandings, representations, or agreements with respect to warranties except as set forth in this policy.

7. NDC Technologies requests immediate notification of any claims arising from damage in transit in order to determine if carrier responsibility exists. If damaged equipment arrives, save the shipping container for inspection by the carrier and telephone NDC Technologies as soon as possible.