



20 twenty years  
of advanced solutions for gas detection

SIL2



Gas Sensing Elements  
Proudly 100% Developed and Manufactured in Italy

# NET3 Plastic IP65 Head

## Instruction manual





THIS MANUAL MUST BE CAREFULLY READ BY ALL PERSONS WHO HAVE OR WILL HAVE THE RESPONSIBILITY FOR INSTALLING, USING OR SERVICING THIS PRODUCT.

Like any equipment, this product will perform as designed only if installed, used, and serviced in accordance with the manufacturer's instructions.

OTHERWISE, IT COULD FAIL TO PERFORM AS DESIGNED AND PEOPLE WHO RELY ON THIS PRODUCT FOR THEIR SAFETY COULD SUFFER SEVERE PERSONAL INJURY OR DEATH.

The warranties made by N.E.T s.r.l. with respect to this product are voided if the product is not installed, used, and serviced in accordance with the instructions in this user guide. Please protect yourself and others by following them.

We recommend our customers to write or call us regarding this equipment prior to use or for any additional information relative to use or repair.

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# 1.0 Introduction

These instructions refer to the installation, use and maintenance of NET3 plastic head gas sensors.

## 1.1 General description

The sensing element inside the enclosure can be either a catalytic sensor, an infrared sensor, or an electrochemical cell.

The industrial grade catalytic sensor (pellistor) employed for the detection of flammable compounds offers a great precision and selectivity with most of the explosive gases, thus avoiding false alarms. Infrared sensors are immune to poisoning produced by certain substances that inhibit and damage catalytic sensors. This allows you to add reliability and durability, allowing the use of detectors even in places where the pellistors cannot guarantee optimal functionality. Electrochemical cells are used to detect gases at low concentration, for this reason they are used to detect toxic gases.

A multi-core cable with 6 conductors allows the connection to power supply and different outputs depending on the sensing element chosen.

Heads with electrochemical cell and pellistor sensors provide only the raw output of the sensing element whereas heads with infrared sensor provide digital output (UART) or voltage output. Plastic heads can house 20mm (4-series) or 32mm (7-series) size sensors from N.E.T.'s full array of detection technologies.

The two-piece design of the housing allows the internal sensor to be field replaceable.

## 2.0 Technical specifications

Table 1) Technical specifications

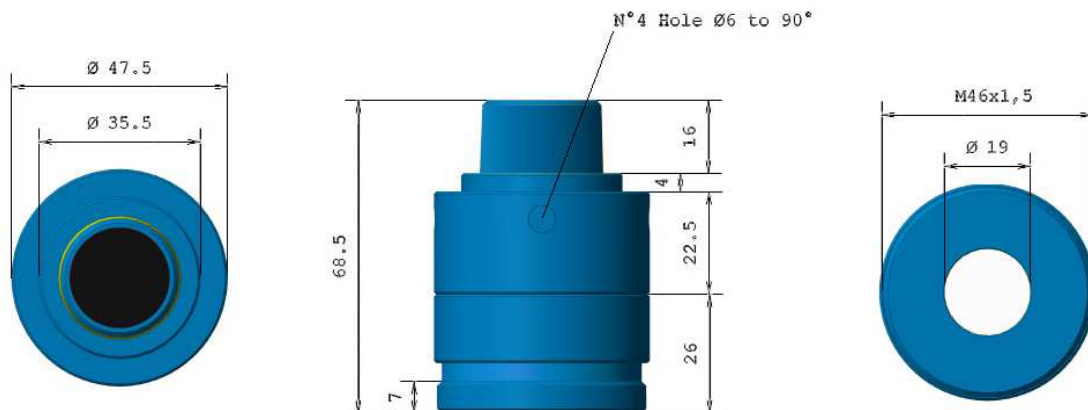
<b>General</b>	<b>Sensing Element:</b>	IR sensor, EC cell, catalytic bead
	<b>Operating temperature range</b>	Sensing elements depend by the sensor technology (See Sensor specification)
	<b>Storage temperature range</b>	Depend by the sensor technology (See Sensor specification)
	<b>Operating humidity range</b>	0-95% NDIR & catalytic 20-90% EC cell
	<b>Operating pressure range</b>	800-1200 mBar NDIR sensor 900-1100 mBar EC cell & catalytic
	<b>Enclosure</b>	Acetal Copolymer IP rating: IP65
<b>Electrical and signal output</b>	<b>Power Voltage</b>	5V NDIR sensor No power EC cell Depending by the sensor for catalytic
	<b>Analog output</b>	0.4 – 2 V NDIR sensor Depending on sensor type EC cell & catalytic
	<b>Digital communication (IR sensor only)</b>	Modbus protocol UART TTL
	<b>Baud Rate (IR sensor only)</b>	4800;9600;19200;38400 bps

## 2.1 Label explanation

Table 2 The data present on the product label are explained below

N.E.T S.r.l.	Name of the manufacturer of the device
NETC32/PB-AIN-IFP32-1ZEL	Example of identification code
CYBER HEAD	Product model
Thread: ¾" NPT	Thread type
Gas: R1234ZE	Example of gas to be detected
F.S: 100%LEL (6.5%Vol)	Example of measuring range
Vin: 12-24 V	Power supply
Output: 4-20 mA	Signal output
Sensor batch: XXXXXX	Sensor Serial Number
IP65	IP degree of protection (1st number: protection against solids, 2nd number: protection against liquids) guaranteed when the optional dust cover is applied

## 3.0 Mechanical Specifications



All dimensions are expressed in mm.

Standard length of the cable is 25cm, other lengths are available on customer's request.

## 4.0 Installation site pre arrangement

### 4.1 General precautions

At the mounting and installation phase, be sure all safety precautions have been considered. Always remember how important the correct positioning of gas sensors is to get the optimum response. Be careful:

- never to install gas sensors close to air intakes or fans causing strong air currents.
- the detectors are attached to a firm base to prevent vibration that can damage them, producing unreliable results. Although the electronics are designed to minimize the influence of electromagnetic interferences, it is advised to keep the detectors at a distance from any radio frequency senders (such as radio links or similar).
- those detectors are placed in a convenient location for future maintenance and calibration requirements.

## 4.2 Precautions based on the gas to detect and environmental inhibitors

When preparing the installation site, it is necessary to consider the nature of the gas to be detected and the presence of chemical agents in the environment.

- All the gases lighter than air (Methane, Hydrogen, Ammonia) tend to spread upwards; the sensor should be placed at 30 cm from the ceiling to maximise the effectiveness of the detection. All the gases heavier than air (LPG, Butane, Petrol Vapours) tend to spread downwards; the detector should be placed at 30 cm from the floor.
- Catalytic sensors (Pellistors) offer excellent output linearity up to 100% LFL and have an estimated lifetime of 4 years. Catalytic sensor performance may be altered by the presence of some substances that, when present in the atmosphere being analysed, can considerably change the response of the sensor, and even damage it irretrievably. The presence of inhibitors or poisons is the most common cause of problems in the gas detection, and, for this reason, it is necessary to pay attention to avoid any contamination. Among the most common poisons or inhibitors we can list silicones, tetraethyl lead, sulphurous compounds (hydrogen sulphide), chlorinated compounds (carbon tetrachloride), trichloroethylene and halogenated hydrocarbons. These compounds do not affect the Infrared sensor, which find a suitable application whenever a flammable gas is to be detected in environments where Pellistor cannot work. This new technology has undoubted advantages such as lower dependence from environmental factors.

### WARNING!

Do not use gas sensors in atmospheres with an oxygen concentration greater than 21%.

## 4.3 Special conditions for safe use

- The supply cable of the gas detector must be protected against mechanical damages caused by impact or friction.
- Power supply must be guaranteed to a stable level without presence of spikes or interruption of the power level.

## 5.0 Installation

The installation should be performed by qualified personnel, consider as example the EN 60079-14 standard. It is strictly recommended the use of personal protective equipment during operations inside the enclosure.

The enclosure of the sensor and the GoreTex filter must not be damaged, drilled or removed. The GoreTex filter must never be touched with bare hands as this alters the properties of the filter.

It is recommended to mount the head with the filter directed to the floor; horizontal mount is permitted but it should be considered that in this orientation, in case of external use, the head is more subjected to be in contact with water and/or deposit of dust.

It is forbidden to mount the head with filter directed to the ceiling because with this orientation any dust or dirt can block the filter and then possibility to detect gas.

## 5.1 I/O Connections

Here are following the indications related to the different signals/connections present for each type of sensing element and each type of heads.

Catalytic bead and Electrochemical cells heads have the same wiring connections for both cable and single wires versions, whereas infrared sensor head has a different wire colour for single wires or cable versions.

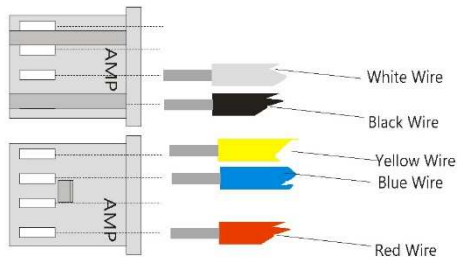
### Wiring for Electrochemical cells and Catalytic pellistors



Wire colour	Catalytic bead Version	Electrochemical Cell Version	Oxygen Cell Version
Red	-Vcc, Detector	Counter	Not used
Black	+Vcc, Compensator	Reference	-Ve
White	Common	Wordking	+Ve

Connector type: AMPMODU II 280359  
Mating connector: AMPMODU II 280371-1

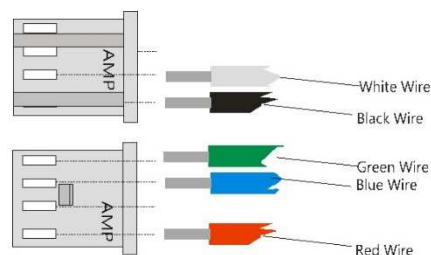
### Wiring for Infrared sensor



Wire colour	Meaning
Red	Vcc (+5V)
Black	GND
Yellow	RX
Blue	TX
White	Signal (Vout)

Connector type: AMPMODU II 280365-0  
Mating connector: AMPMODU II 280384-1

### Wiring for Infrared sensor



Wire colour	Meaning
Red	Vcc (+5V)
Black	GND
Green	RX
Blue	TX
White	Signal (Vout)

## 5.2 Safety data

Infrared sensors have been designed to be used in applications requiring SIL Capability. Please ask to technical support to receive the related information and to get precise information about order codes.

## 5.3 Output connection

- Use shielded cables in case it is needed to reduce EMC interference
- Wires' cross section depends on the distance between the detection head and the equipment at which it is connected. Maximum recommended distance could be of some meters in case of infrared and catalytic bead whereas it could be less than 1 meter for electrochemical cell
- Should any junctions be necessary on wires, please make sure there is no interruption on the shield
- Ensure the wire connections, either clutching or crimping type, are properly carried out with terminals that do not oxidise or loosen. We recommend having them soldered or using the mating connector.

Remember always that electrochemical cells have a current output whereas infrared and catalytic bead generate a voltage output.

## 5.4 UART digital connection

Differently from the other sensing technology, Infrared sensor could be also connected to the interfacing equipment using digital communication through UART line. Communication protocols is implemented based on Modbus standard.

Connection of the head to UART line should be performed by using a 4-wire cable, 1 pair for the UART bus and 1 for the power supply.

It is also necessary that:

- The total length of the line should not exceed some meters.
- Detectors heads and interfacing instrument are to be wired in daisy chain mode. We recommend avoiding star or tree mode connection as interference immunity would be reduced.
- For the detectors' power supply connection, we recommend using a 2-wire cable with suitable section according to the distance and number of detector heads connected.
- Once the installation has been completed, verify that each detector head reaches at least 5Vdc.

To set the detectors' address, please refer to the technical communication manual of Infrared sensor.

When detectors are connected using digital communication, the proportional Voltage output remains active.



## 6.0 Testing and use

### 6.1 Power on

Once infrared head is powered on, output voltage is nearly 400mV in voltage standard mode or  $V_{in}/2$  in case of Bridge output. In the first one-minute from power on, the output Voltage will remain at this level then it will assume the value related to the measured gas concentration level.

Once the warm-up phase is over, the infrared sensor can work correctly, although the optimal performances will be achieved after two hours.

Electrochemical cells and catalytic beads before to provide a stable output should be kept stabilizing for a couple of hours from power on.

### 6.2 Testing

Detectors are factory calibrated for the specific gas required by the customers. Future adjustment of the pre-set calibration can be carried out through digital communication.

#### IMPORTANT!

Check the functionality at least one time per year, by testing detector response with gas application.

Testing / initial checking and calibration should be carried out by using a gas mixture in the appropriate range, along with our calibration kit.

To execute this operation, the user must use the proper test gas bottle and connect to this the valve with flowmeter. Connect a pipe with adequate diameter, which connects to the calibration adapter for the gas detector. The calibration of the detector is made by handheld calibration keypad or the related calibration SW. Ask to N.E.T for more details about the accessories for calibration.

Please consult the specific instruction manuals for further information on use. We recommend recalibrating hydrocarbon detector with Infrared technology in both zero and span condition, zero calibration should be made applying Nitrogen, in case zero calibration will be performed in ambient air then span calibration should be performed applying target gas using a nafion tube interposed between calibration gas cylinder and detector head.

## 7.0 Maintenance

It is recommended that maintenance activities will be performed by trained staff following EN 60079-17 criterion.

### 7.1 Preventive maintenance routines

The preventive maintenance routines can be carried out according to EN/IEC 60079-17 Standard. Moreover, all industrial gas detectors for flammable gases or for toxic gases should be verified with a test mixture every one or three months according to the installation and plant type and according to the work duty.

## 7.2 Corrective maintenance routines

If any anomalous conditions occur during test operations, please repeat the test phase. Should the detector not react to the gas it has been calibrated for, please send it back to your supplier, for him to return it to the manufacturer or to a N.E.T. authorized technical centre for the repair.

## 7.3 Note on IP grade

Please note that the IP rating indicated on the instrument label does not imply that the equipment will detect gas during and after exposure to those conditions of dust and water intrusion. If exposed to the condition's representative of the IP rating, the equipment should be checked and recalibrated with a higher frequency and in case of damage of the IP protection cap, it must be replaced. The PTFE filter of the IP protection cap should by no means be touched by bare hands as this may alter the protection and the response in gas.

## 7.4 Cleaning

The detectors must be kept clean of dust deposits. Cleaning must be performed with damp cloths or with cloths that do not accumulate electrostatic charges. It is strictly forbidden the dust cleaning using compressed air.

## 7.5 Disassembly instructions

Power the unit off, disconnect the wires on the terminals and dismount the housing from any blocking systems.

The opening of sensor head can be conducted in safe zone and without power source. After 10 minutes from power source interruption, the equipment can be opened. It is strictly recommended the use of personal protective equipment during operations inside the enclosure.

## 7.6 Trouble shooting guide

The following table lists all the error messages, which can be encountered, with corrective actions to resolve the problems with infrared sensor. Once infrared sensor is in error status voltage output is set to 200mV or  $V_{in}/2-100mV$ . Digital concentration is set to -20%F.S and the related error is indicated to the specific error register.

Table 3) Error messages with their corrective actions for Infrared head

IR Sensor Error Code	IR Sensor Error Name	Error Description	Corrective action
0x00	NO_ERROR	None	None
0x02	E2PROM_CKSM_ERROR	Internal E2PROM error	
0x03	FLASH_CKSM_ERROR	Internal FLASH error	
0x04	RAM_ERROR	Internal RAM error	
0x05	VDD_ERROR	Internal Power supply fail	
0x06	I2C_ERROR	Internal communication error	
0x08	SPI_ERROR	Internal communication error	<ul style="list-style-type: none"> <li>➤ Turn power off, then on again.</li> <li>➤ If the previous action does not resolve the error, please contact N.E.T.</li> </ul>
0x09	VREF_ERROR	Internal Vref error	
0x0A	DAC_ERROR	Internal DAC error	
0x0C	ANALOGUE_4-20MA_ERROR	Output voltage does not correct	
0x0E	ADC_ERROR	Internal ADC error	
0x0F	SW_ERROR	Internal calculation error	
0x10	VIN_ERROR	Power supply level not correct	Verify input power that meets Sensor's power supply range
0x11	FLASH_READ_ERROR		
0x12	FLASH_WRITE_ERROR	Internal FLASH error	<ul style="list-style-type: none"> <li>➤ Turn power off, then on again.</li> <li>➤ If the previous action does not resolve the error, please contact N.E.T.</li> </ul>
0x13	FLASH_ERASE_ERROR		
0x14	E2PROM_WRITE_ERROR	Internal E2PROM error	
0x16	RFI_ERROR	Internal signals not stable	Verify if Electromagnetic disturbances are present in the working environment.
0x17	VBG_ERROR	Internal Band gap error	
0x18	LAMP_ERROR	IR LAMP not work	<ul style="list-style-type: none"> <li>➤ Turn power off, then on again.</li> <li>➤ If the previous action does not resolve the error, please contact N.E.T.</li> </ul>
0x19	AMP_ERROR	OP AMP not work	

Infrared sensors also indicate presence of warning.  
Inside the following table are indicated warning of the detector and the related codes:

Table 4) Warning messages with their descriptions for Infrared Head

IR Warning Code	Sensor	IR Sensor Warning Name	Warning Description
0x00		NO_WARNING	(no warning, functioning ok)
0x01		WARMUP_WARNING	(warm-up)
0x02		INVALID_ACTIVE_WARNING	(active not included within the functional limits expected)
0x04		INVALID_REFERENCE_WARNING	(REF not included within the functional limits expected)
0x08		INVALID_TEMPERATURE_WARNING	(TEMP not included within the functional limits expected)
0x10		INVALID_READINGS_WARNING	(active and reference signals changed too fast. This condition can happen in case of fast gas flow rate transient, fast temperature changes and presence of radio frequency,interferences. In case this flag is active then gas concentration is freed)
0x20		INVALID_ACTIVERMS_WARNING	(WRONG VALUES on the active channel. Active signal is too low)
0x40		INVALID_REFERENCERMS_WARNING	(WRONG VALUES on the reference channel;.Reference signal is too low)
0x80		HW_TEST_WARNING	(HW test in progress. It is performed once per day)

## 8.0 Restorations

Restorations are not allowed; the user must give the entire equipment to the manufacturer with the RMA number required in advance to return the goods.

## 9.0 Packing instructions

To grant a stout protection against impacts we recommend using the original package or protect the device with bubble wrap sheets.

## 10.0 Warranty for repairing

Warranty on N.E.T products is valid one year from the delivery date placed on transportation documents. Defective products can be returned to N.E.T. Srl only after a previous agreement and with a description of the fault. N.E.T. Srl has the right to replace or repair all the products that, according to his unquestionable judgement, are found to be defective, without being held responsible for any possible direct or indirect damages suffered by the Customer. According to the above-mentioned warranty, shipping and packaging charges and any other incidental expenses for the products returned to N.E.T. Srl will be at the Customer's own risk and charged to him. This warranty however is not valid for articles that have been broken, repaired by a third person or not used according to the instructions contained in this document or supplied with the products, related to the storage, installation, operation, maintenance, or servicing of the products.

### IMPORTANT!

Please be aware that all perishables installed in our products (sensors) benefit only of the warranty conditions stated by the original manufacturer.

## 11.0 Instructions for disposal

When the device reaches the end of its life, it should be disposed of in accordance with local waste management requirements and environmental legislation. Employed materials are subdivided into the following categories:

- Sensor head enclosure: plastic
- Electronic boards: Waste Electrical & Electronic Equipment (WEEE)
- Sensing element: Waste Electrical & Electronic Equipment (WEEE)

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