

# Metran-100, Metran-49 Series Smart Pressure Transmitters

## DEVELOPMENT OF SMART FIELD DEVICES IS THE PATH TO THE TECHNOLOGIES OF TOMORROW

Metran-100 Smart Pressure Transmitter Series fully replaced a variety of Metran-22,-43,-44,-45, Sapphire-22M.

For unification of pressure receivers design series we chose type representatives (base models) of replacement transmitters (see Table 1 "Metran-100 Series Smart Pressure Transmitters").

**Microprocessor electronic use** in the electronic converter design of Metran-100 transmitters and Metran-49 transmitters has allowed:

- to obtain wide variety of adjustment and calibration functions;
- to increase adjustment accuracy and decrease total measurement error when operating the transmitter in real service conditions;
- to extend rangeability (25:1, 16:1, 10:1);
- to provide continuous self-diagnostics;
- to use digital communication protocols.

**HART communication protocol** has provided:

- Metran-100 transmitters and Metran-49 transmitters use in both analog and digital systems compatible with HART-protocol (analog signal 4-20 mA and digital signal on the basis of HART-protocol are transmitted simultaneously through one pair of wires);
- two-way information exchange between transmitter and control HART-device: Metran-650 portable hand-held HART-communicator or other HART-master, and also computer with HART-modem and special program created by Metran IG;
- remote control and transmitter parameters testing.

### Metran-100, Metran-49 Transmitters (MP, MP1 codes)

Digital values of transmitter's signal are shown on liquid crystal display of a digital indicator built-in the electronic unit housing. The digital indicator can be also manufactured as remote indicator (VI) connected to the transmitter through a special connector. With the help of built-in push button control panel it is possible to carry out:

1. Current measured pressure value control;
2. Control of transmitter parameters adjustment:
  - zero mode automatic calibration of a transmitter output signal;
  - measurement units adjustment;
  - time adjustment of output signal setting (damping);
  - measurement range readjustment including readjustment to non-standard range;
  - Lower Range Limit (LRL) setting;
  - choice of forward, linear, inverse or root-extracting characteristic of output signal;
3. Transmitter calibration.
4. Protection from unauthorized adjustment.

### ● Metran-100, Metran-49 Transmitters compatible with HART-protocol (MP2, MP3 codes)

Transmitter and sensor parameter adjustments, configuration, calibration, testing, information readout about process variables, current measurement mode, URL and LRL in current measurement units and other operations are accomplished remotely from transmitter with the help of HART-control devices.

While testing, on-line status check is carried out for:

- microprocessor;
- ROM on ADC board;
- reprogramming memory of microprocessor;
- current mode of transmitter operation;
- connection with ADC board;
- sensor.

It is possible to install security record mode, that fully prevents any change of transmitter parameters, security record mode can be password-protected.

Transmitter handling through a digital line is performed with the help of portable hand-held HART-based communicator or personal computer with HART-based modem.

HART-based protocol allows two controlling units in the system (e.g. operator computer and hand-held communicator).

**● Metran-100 transmitters (MP4, MP5 codes with RS485 port)**

Parameter adjustment, control and calibration of microprocessor transmitters with codes MP4, MP5 can be performed both with the help of process control system, and the ICP-Master program. The program works on OS Windows 9x/NT/2000/XP. To provide the program and transmitter combined function a special RS232/RS485-converter is needed. The converter with autodetection transmit direction (e.g. ADAM4520 made by Advantech), is connected to serial COM-port of a computer.

The ICP-Master program perfectly supports RS485 terminal transmitters. The program makes it possible to get and install new transmitter configurations, to get and assign new range limits, to get and change housekeeping information, to change the status of security record mode and to perform transmitter calibration. The program also provides a Russian version of help system.

**FOR ALL METRAN-100, METRAN-49 TRANSMITTERS:**

- **continuous self-diagnostics** provides control over transmitter operation and reports failure;
- failure information about MP4, MP5 codes transmitters operation is available on request through digital communication line;
- **zero setting** of a transmitter is performed by a simple press of an external button without depressurization of electronic converter housing and without violation of explosion protection requirements. It is especially important for transmitters of the explosion-proof type, as it is not necessary to disassemble and remove transmitter from explosive areas;
- **in measurement mode** display of a digital indicator of MP1, MP3, MP5 codes transmitters, display of VI and HART-communicator show current value of measurable pressure (for DIV - taking the sign into consideration) in chosen measurement units (Pa, kPa, MPa, kgf/cm<sup>2</sup>, % of set measurement range). The digital indicator fully keeps its working capacity in an ambient temperature range from -40 to 70°C.

**SERVICE ADVANTAGES OF HART TRANSMITTERS**

- User-friendly transmitter servicing in operational conditions.
- Reduction of installation costs.
- Time savings on adjustment and calibration when commissioning.
- Costs and time savings on:
  - transmitter maintenance due to on-line trouble-shooting;
  - reduction of amount of time for transmitter maintenance due to remote diagnostics and configuration;
  - periodic check (This is not required the first 3 years);
  - repairs (supplier's warranty period has been increased to 3 years).
- Replacements for similar import transmitters.

***Metran-100 purchasing costs will be generously repaid during operation***

### INFORMATION YOU SHOULD KNOW WHEN CHOOSING METRAN-100 PRESSURE TRANSMITTER WITH RS485-BASED DIGITAL OUTPUT SIGNAL

The model of communication protocol digital interface performs three model layers of OSI (Open System Interconnection) i.e. Physical, Data Link and Application, with each of them having a special function.

**Physical Layer** describes signal parameters (modulation method, signal type and level), and transmission medium.

EIA RS485 interface is used as a physical layer.

Parameter adjustment, control and calibration of microprocessor transmitters with codes MP4, MP5 can be performed remotely both with the help of process control system, and RS485/RS232 modem with the ICP-Master program.

When line placing we recommend to use twisted pair cable with wave impedance of 120 Ohm. Maximum length of communication line is 1200 m.

Maximum transmitter quantity (including control system) is 32.

**Data Link Layer** operates physical medium access, controls the local network, reception and serial message transfer. The protocol connection principle is the following:

Chief, or Master (the controller, data collector, administrative computer) - Subordinate (Metran-100 transmitter, sending reply to Master's request). A message represents ASCII symbol line. Messages are coded as a sequence of eight-bit bytes and are transmitted through standard UART (Universal Asynchronous Receiver/Transmitter) to send each byte.

On the protocol basis it is possible to work at the following rates: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 bps.

Rate of exchange is set up in transmitter configuration and can be changed. Default data rate is 9600 bps and 01 h address.

**Application Layer** describes Metran-100 transmitter supported commands, e.g.:

- Pressure values recognition
- Configuration record (transmitter network address, communication line rate, data format, damping time, measurement units)
- Zero pressure calibration
- Setup of pressure measurement range
- Pressure URL calibration
- Pressure LRL calibration
- Configuration recognition
- Status recognition etc.

### INFORMATION YOU SHOULD KNOW WHEN CHOOSING A LEVEL MEASUREMENT PRESSURE TRANSMITTER

#### Fluid parameters in tank:

- temperature;
- pressure;
- density (density change depending on temperature);
- viscosity (possibility of sediment formation on diaphragm surface or inlet line blockage).

#### Fluid condition in tank:

- homogeneity;
- presence of skim;
- presence of suspended particles;
- vorticity (presence of blenders).

#### Ambient conditions:

- tank installation indoors or outdoors;
- ambient temperature;
- vibration;
- electromagnetic interference.

#### Physical features of tank:

- small size (impossibility of transmitter installation on tank);
- double walls;
- access to transmitter installation site (tank is under the ground);
- excessive pressure above fluid.

#### Level transmitter technical characteristics:

- conformance of transmitter metrological specifications to the required measurement accuracy level;
- pressure transmitter versions, meeting safety requirements (e.g. explosion-proof version) and supporting certificates licences;
- presence of required output signals (analog or digital);
- durability;
- stability.

Pressure difference transmitters and hydrostatic pressure (level) transmitters can be used for level measurement in open tanks, in closed but vented tanks, in closed tanks under pressure.

Pressure difference and hydrostatic pressure (level) transmitters can work only with homogeneous fluids.

Metran-100-DG Hydrostatic pressure (level) transmitters and Metran-100-DD Differential pressure transmitters, used for level measurement, measure column of fluid hydrostatic pressure and provide constant pressure value transformation into normalized current and/or digital signal through HART protocol.

Fluid column pressure is determined by such factors as level and relative density of fluid. This pressure does not depend on tank volume and form and is calculated by the formula:

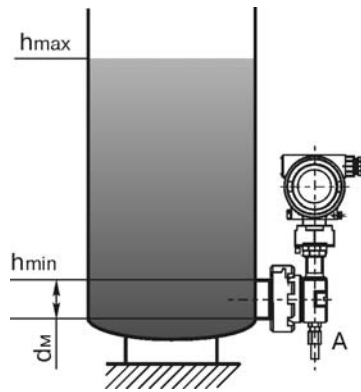
$$P = ( h_{max} - h_{min} ) \cdot \rho,$$

where  $h_{max}$ ,  $h_{min}$  - maximum and minimum fluid level;  $\rho$  - relative density.

Normally, hydrostatic pressure transmitters are installed on a tank sidewall close to the bottom. It is possible to install a transmitter on a tank bottom if it is accessible for mounting and maintenance, and if there is no threat of sediment formation on transmitter diaphragm.

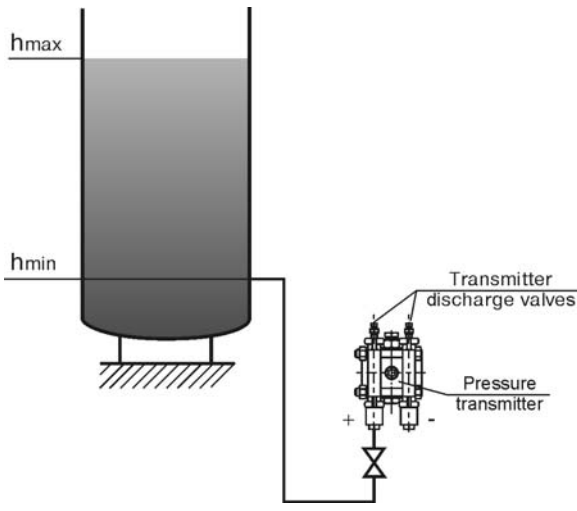
**OPEN TANKS**

In open tanks, hydrostatic pressure transmitter measures the pressure that is equal to the column of fluid height above it.

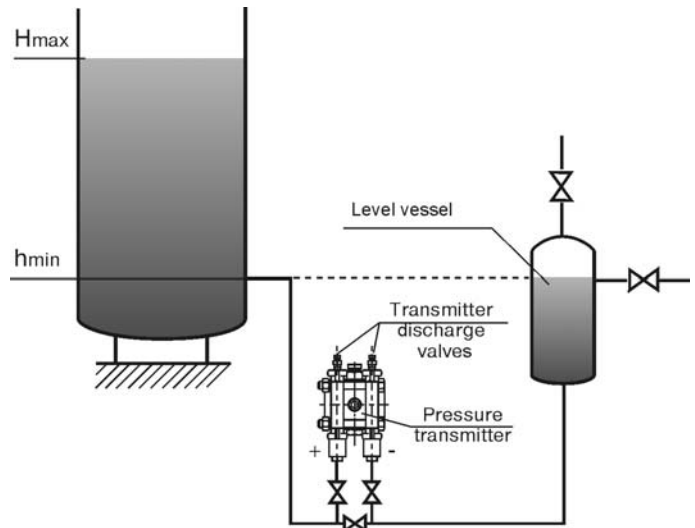


**Note:** transmitter is adjusted to pressure from the open diaphragm; connector "A" is vented to the atmosphere.  
 $d_m$  - transmitter diaphragm diameter.

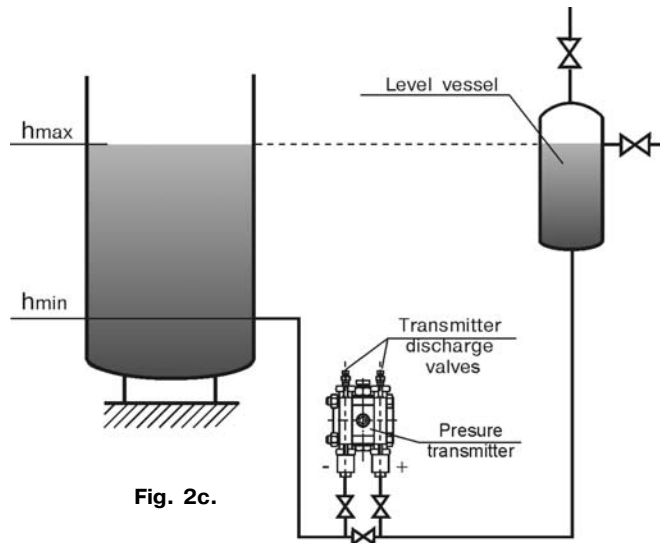
**Fig. 1. Installation of Metran-100-DG Transmitters of Models 1533, 1543, 1531, 1541 when measuring the hydrostatic pressure in open tank.**



**Fig. 2a.**



**Fig. 2b.**

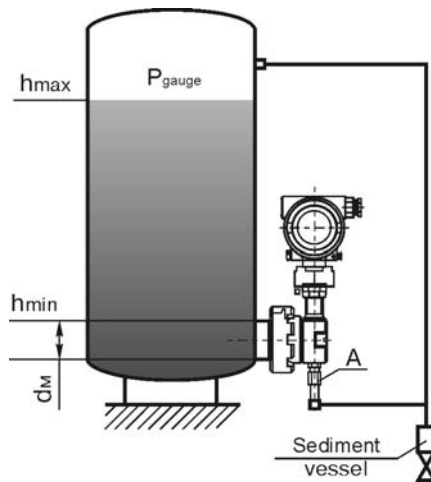


**Fig. 2c.**

**Fig. 2. Installation of Metran-100-DD Differential Pressure Transmitter when measuring the level in open tanks.**

### CLOSED TANKS

In closed tanks  $P_{\text{gauge}}$  above the fluid influences the measurement result. Therefore  $P_{\text{gauge}}$  should be applied to a pressure transmitter, linking the static transmitter hole up with tank volume above fluid.

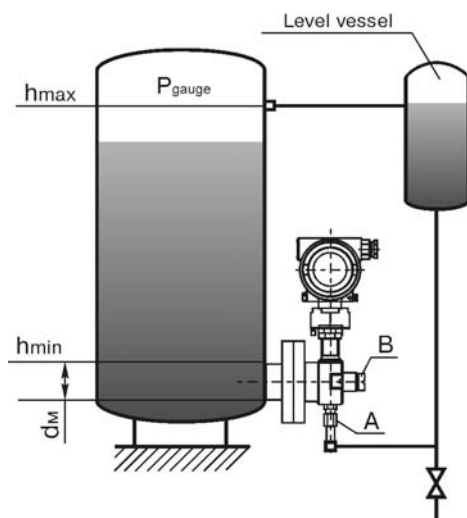


#### Notes:

1. The medium in the upper part of tank does not condense.
2. The transmitter is adjusted to pressure from the open diaphragm.

**Fig. 3. Installation of Metran-100-DG Transmitters of Models 1533, 1543, 1531, 1541 1532+, 1542+, 1534+, 1544+** (the transmitter is adjusted to pressure from the open diaphragm) when measuring the level in closed reservoir under pressure.

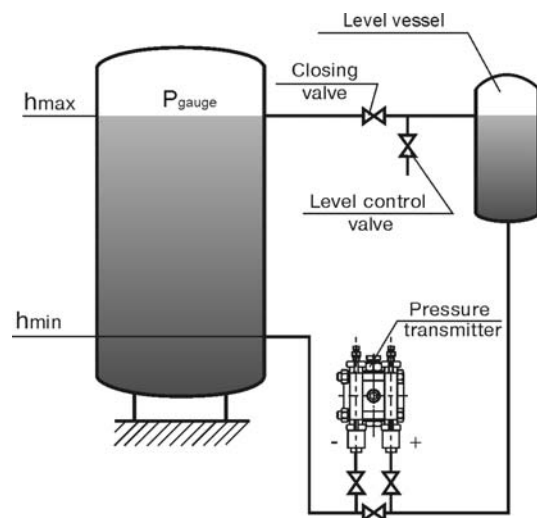
In cases when it is impossible to avoid heavy condensed fluid forming and accumulation in a pipe, linking the transmitter up with tank volume above fluid, we recommend to use connection diagram of a transmitter level vessel and connecting pipe, filled up with fluid. Fluid density should be the same both in tank and in level vessel.



**Fig. 4. Installation of Metran-100 DG Pressure Transmitters of Models 1532, 1542, 1534, 1544** when measuring the hydrostatic pressure in closed tank.

#### Note:

1. The medium in the upper part of tank condenses.
2. The transmitter is adjusted to pressure from connector "A".
3. Unlike installation of a transmitter according to Figure 1 and 3 with maximum fluid level in tank  $h_{\text{max}}$  the transmitter display shows "0", and with minimum level  $h_{\text{min}}$  the display values correspond to URL.



**Fig.5. Installation of Metran-100 DD Differential Pressure Transmitter** when measuring the level in closed tank under pressure.

#### ATTENTION!

The operating medium temperature should not exceed 80°C when measuring the level with the help of Metran-100-DG. Fill in and send a questionnaire to order a transmitter (see next page).

**QUESTIONNAIRE**  
to order Metran-...-DD, Metran-...-DG transmitters for level measurement

Project \_\_\_\_\_ optional

Specification \_\_\_\_\_ optional

Customer (Consignee) \_\_\_\_\_

Postal, telephone and fax number of Customer \_\_\_\_\_

**To be ordered:**

1. Transmitter \_\_\_\_\_ units  
plant designation \_\_\_\_\_ quantity \_\_\_\_\_

2. Separation vessels \_\_\_\_\_  
if necessary \_\_\_\_\_

3. Level vessels \_\_\_\_\_  
if necessary \_\_\_\_\_

4. Liquid \_\_\_\_\_

5. Liquid temperature \_\_\_\_\_

6. Liquid gage pressure:  
operating \_\_\_\_\_ MPa  
maximum \_\_\_\_\_ MPa

7. Liquid density or specific gravity under conditions stated above (No. 5 and 6) \_\_\_\_\_ kg/m<sup>3</sup>  
do not fill in for water

8. Level measurement limits \_\_\_\_\_

9. Extra information (at the discretion of Customer)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

10. Name and address of company, that filled in the questionnaire

\_\_\_\_\_  
\_\_\_\_\_

**Project Company**

Instrumentation and Control Coordinator \_\_\_\_\_  
(signature, surname, phone number)

**Customer:**  
Administrative Manager \_\_\_\_\_  
(signature, surname, phone number)

Prepared by \_\_\_\_\_  
(signature, surname, phone number)