HOKKAIDO

Digital Ammeter for monitoring the power consumption: DTA-IHXR

Installation & Operation Manual

■ Please keep this specifications Manual properly.

■ Read this specifications Manual carefully before using the equipment.

Table of Contents

PRESENTATION & PRECAUTIONS

■ Acknowledgments

Thank you for your confidence in HOKKAIDO DTA-IHXR Digital Ammeter for 3-Phase Outdoor Units.

■ Use of the Specification Manual

This specification Manual describes the installation of Digital Ammeter and the conditions of operating it. For future reference, please keep this Manual properly after the device's installation and testing.

■ **Accessory components & available functions on** DTA-IHXR device

1. The advanced functions for monitoring the power consumption that DTA-IHXR is able to carry out need the connection of each Outdoor Unit to a control signal network, on which other hardware devices and a specific software have been installed.

2. A specific DTA-IHXR device must be connected to each Outdoor Unit.

3. For the dialogue between DTA-IHXR and each Outdoor Unit, it is needed the use of the pair of contacts "O" & "A" on the terminal block of the Outdoor Unit you would like to monitor.

4. For monitoring the electric power consumption, it is also needed at least one Centralized Controller for Outdoor Units "DTCO-UHXRV" (which can control and monitor up to max. 64 Outdoor Units), and the connection to a Personal Computer provided with a Software package BMS-UHXRV (original Software, specific for *"Building Management System"*) with corresponding Hardware (RS-485/RS-232 Converter) for the connection between the control signal network and the Personal Computer.

5. Through DTA-IHXR and the accessory components described above, it is therefore possible:

- To monitor and record (and consequently consult, via software) the data referred to the quantity of electricity on each one of the 3 power supply Phases.
- To monitor and record (and consequently consult, via software) the data referred to the total quantity of electricity on the 3 power supply Phases.

■ Appearance and functions of DTA-IHXR

• The data referred to the quantity of electric power consumption are displayed on a wide red LED display, with 6 digits. Each digit is composed of 7 bright segments.

• The unit indicated besides the device's LED display is: "kWh" (more exactly: kW-h, that is "kilowatt-hour"). This measurement unit is normally used to measure the quantity of energy which is produced and/or used for domestic and/or industrial purposes for a certain time interval (1 hour). This measurement unit is also the one that is chosen for electric consumption invoicing by the Electrical Company. Therefore, DTA-IHXR is a "time wattmeter".

• Below the LED display, there are 3 LED diodes, respectively of Yellow, Green and Red colour. Each LED lights up if the corresponding power input to DTA-IHXR is missing/interrupted. Below each LED, there is an indication that identifies the LED, as regards the power supply phase which the LED refers to, that is: Yellow LED for Phase "A"; Green LED for Phase "B"; Red LED for Phase "C".

• The terminal block is set on front side of the device, and is protected by a cover that is fixed by 2 screws. The access to the terminal block is easy, as the cover's fixing screws may be removed also without a screwdriver: in fact, the screws' head is cylindrical and knurled sideways, so that the screws can be unscrewed by hand.

• On terminal block, the contacts for connecting of high voltage wires (input: connection to control board; output: connection to the power terminal block of Outdoor Unit) are of screw type.

• On terminal block, the contacts for connecting of low voltage wires (connections to the terminals "O" & "A" of Outdoor Unit's PCB respectively to the contacts "I" & "II" for the dialogue between DTA-IHXR and the Outdoor Unit's PCB; output connections "III" & "IV" for outside "passive" transmission of impulses - not required for installation puroposes - detected by DTA-IHXR), are of "faston" kind.

■ For further information and/or eventual explanations

In case of doubt or whatever need referred to operation or use of DTA-IHXR, please contact the Dealer who provided the device and/or the air-conditioning systems.

1. PRODUCT'S OUTLINE & SPECIFICATIONS

■ General Outline of DTA-IHXR

1. This DTA-IHXR device is an electric power consumption detector (in short, it is a "time wattmeter") for 3-Phase power supply appliances.

It is a new-concept product, in accordance with the specifications established by EN/IEC 62053-21 : 2003 Regulations.

2. This Manual refers to the installation of DTA-IHXR, for measuring and monitoring of electric power consumption needed for operation of 3-Phase Outdoor Units of "XRV HOKKAIDO Systems".

3. For design and making of this device, the "Surface Mount Technology" (""SMT") has been used. This technique is used in electronics for assembling a "Printed Circuit Board" ("PCB"), which foresees the application of electronic components on the circuit's surface, without need of making holes (unlike it is required by the classic technique).

4. The typical use of DTA-IHXR is the following: to monitor and register (and consequently to consult, via software) the data referred to the quantity of electricity on each one of the 3 power supply Phases; to monitor and record (and consequently to consult, via software) the data referred to the total quantity of electricity on the 3 power supply Phases.

5. On the device, there are 3 LED diodes, respectively of Yellow, Green and Red colour. Each LED lights up if one of power input to DTA-IHXR is missing/interrupted. Below each LED, there is an indication that identifies the LED, as regards the power phase to which the LED is referred, that is: Yellow LED for Phase "A"; Green LED for Phase "B"; Red LED for Phase "C".

The communication between DTA-IHXR and the outside devices may take place both by a serial transmission connection RS-485 and by infrared connection (even if the latter cannot be used for monitoring electric power consumption). The communication protocols implemented in the device are in accordance with LD/T645-1997.

6. The main features of DTA-IHXR are the accuracy and steadiness of measurements, and the resistance to outside electromagnetic noises.

Fig. 1: Outline of parts and components of DTA-IHXR.

■ Product's features

1. Modern and functional design, structural good quality, easy installation and no need for maintenance.

2. By the Red LED Display, the data are shown with accuracy and in sequence concerning the amount of electricity on each one of the 3 power Phases of the Outdoor Unit; at the end of the sequence, the data are displayed concerning the total amount of electricity on the 3 Phases (that is the sum of 3 Phases) of Outdoor Unit.

3. The electronic components used are in accordance with the higher indistrial quality standards, and are characterized by low consumption and high resistance to electromagnetic noises.

4. The data referred to the detected amount of electricity can be sent to a Personal Computer by the serial connection RS-485, and then exported and saved, for future need of consultation, inside BMS-UHXRV Software.

5. Output connections "III" & "IV" allow the eventual outside transmission ("passive" mode) of impulses detected by DTA-IHXR, for reading the impulses and calibrating the device.

■ Operation principles of device

1. The amount of energy is detected by 3 integrated circuits (IC) AD7755, specific for measurement, before they are sent to the microprocessor (CPU).

For each AD7755 integrated circuit, the sequence of steps between the measurement of energy amount and the data sending to the CPU, is shown by the following flowchart:

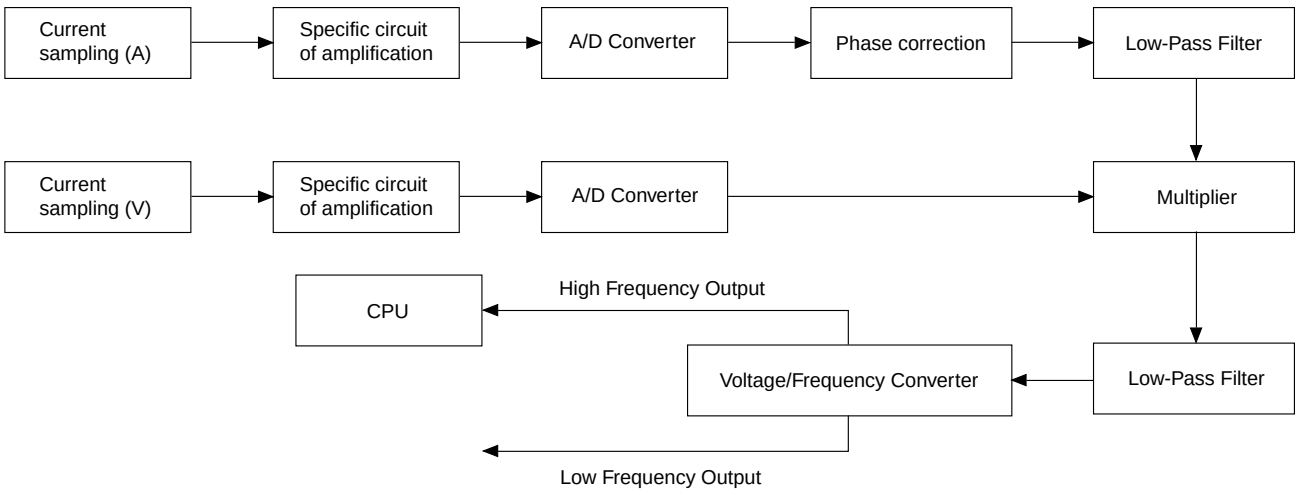


Diagram 1

First of all, data referred to voltage signals on each one of 3 Phases are sampled by special resistors in analogue format; at the same time, data referred of current signals on each one of 3 Phases are sampled by the current transformer in analogue format. Then, the sampled data are sent to AD7755 integrated circuit for measurement. The instant measurement of the amount of energy is carried out by the amplification of differences between data, separate A/D conversion, and following multiplication. Then, at Voltage/Frequency Converter output, the signal transmission of frequency impulses takes place; the amount of these signals (impulses) is directly proportional to the medium value of the measured amount of energy; among these signals, the high frequency signals are sent to the device's CPU (microprocessor), while low frequency signals are not transmitted. Output "III" & "IV" connections on DTA-IHXR allow the eventual outside transmission ("passive" mode) of high frequency impulses, for reading the impulses themselves and for adjusting the device.

■ Data processing by CPU (microprocessor)

Data referred to energy amount measured on the 3 Phases are transmitted to CPU through a serial bus that works as peripheral interface, and at this point CPU starts processing these data, thus guaranteeing the storage recording of total amount of energy for each phase. Besides, CPU controls the circuit of DTA-IHXR's LED display for displaying of numeric values at right moment. It is possible to enter a part of stored data, by connection via RS-485 (upon passage through RS-485 → RS 232 conversion interface, and from this interface to Personal Computer) or by infrared connection (this kind of connection is not used for monitoring the power consumption of Outdoor Units).

■ Technical specifications & performance features of DTA-IHXR

1. Working parameters of device.

   - Voltage range of device: AC220V ± 20% / 50Hz.

   - For reference values of measured voltage, measurement accuracy, calibration of device and equivalence between the number of impulses and the amount of energy measured, please refer to "Table 1" at the next page.

Ref. Voltage	Accuracy Class	Currenmt Spec.	Equivalence impulses/amount of energy
3 x 380V/50Hz	Class 1.0	15(60)A	400imp/kWh

Table 1

- As far as margins of error are corncerned (percentage gap) about measurements, please refer to the following Tables.

(With balanced load)

Load Current (A)		Power Factor	Percentage error (%)
Whole Current	Transformer Current		(Class 1.0)
0.05 $I_b \le I < 0.1\ I_b$	0.02 $I_n \le I < 0.05\ I_n$	1.0	±1.5
0.1 $I_b \le I \le I_{max}$	0.05 $I_n \le I \le I_{max}$	1.0	±1.0
0.1 $I_b \le I \le 0.2\ I_b$	0.05 $I_n \le I < 0.1\ I_n$	0.5L, 0.8C	±1.5
0.2 $I_b \le I \le 0.1 I_{max}$	0.1 $I_n \le I \le I_{max}$	0.5L, 0.8C	±1.0

Table 2

(With unbalanced load)

Load Current (A)		Power Factor	Percentage error (%)
Whole Current	Transformer Current		(Class 1.0)
0.1 $I_n \le I \le I_{max}$	0.5 $I_n \le I \le I_{max}$	1.0	±2.0
0.1 $I_n \le I \le I_{max}$	0.1 $I_n \le I \le I_{max}$	0.5	±2.0

Table 3

- Temperature range for device operation. With temperatures from -25°C to 55°C, the device works in normal operation conditions; with temperatures from -40°C to 79°C, the device works in limited operation conditions.

- Voltage for starting of measurements. This device starts measurements if load current is 0.004 I_b (or if the transfomer current is 0.003 I_b, provided that voltage & current reference values are respected, and that COS Φ = 1.0.

- Potential difference for starting of measurements. This device sends no impulse if the potential difference between one of the phases (V_A, V_B, V_C) and Vn is higher than 115% of reference voltage value; however, even if these conditions occur, there is no power cut to the power supply circuit of the connected appliance.

- Power input of the device: not more than 2W/10VA as far as the voltage circuit is concerned; not more than 1VA as far as the current circuit is concerned.

2. Performance features of DTA-IHXR.

- Energy amount recording. DTA-IHXR is able to detect and store the energy amounts on each power Phase of the connected Outdoor Unit, and the whole energy amount as a sum of the values that are detected on the 3 power Phases. The measurement of energy amount takes place in unidirectional way, also if power Phases of connected appliance are inversed.

- Communication interfaces to outside. The communication between DTA-IHXR and outdoor devices may take place both by RS-485 transmission serial connection and by infrared connection (but the latter mode cannot be used for monitoring electric power consumption).

- Programming the device. Inside the device's body there is a microswitch for programming some inner functions of DTA-IHXR. The programmation procedure may take place by one of the two communication interfaces (see the previous item) which the device is provided of. For this operation, a password for access is required. Moreover, by this procedure it is also possible to set again the device's serial number, to modify the display function of the information sequence on LED display, and finally to modify the password for programmation.

- Displayed information sequence. On LED Red display (with 6 digits) of DTA-IHXR, data referred to electricity amounts on each one of the 3 power supply Phases of Outdoor Unit are displayed with accuracy and in sequence (by intervals of about 3 seconds between each display and the following one): "A", "B" or "C" lights up on the display; at the end of this sequence, data referred to the electricity amounts on whole 3 power supply Phases (sum of 3 Phases) of Outdoor Unit are displayed.

The range of displayed values on LED display is from "0 kWh" to "99:99:9.9 kWh". However, the real higher limit of energy quantity that can be measured by the device is of 999999.99 kWh; even if the first and the last digits of this value cannot be displayed by LED display (6 digits), real values can be read by remote through RS-485 transmission serial connexion. In the end, if the measured energy quantity is higher than 999999.99kWh, LED display will show "0 kWh"), and when calculating the electric absorption, the difference exceeding this value will be put it manually.

- Notification of a cut/lack of one of power supply phases. Below LED display, there are 3 LED diodes, respectively of Yellow, Green, Red colour. Each LED lights up when the corresponding power supply phase input to DTA-IHXR turns out to be lacking/cut. Below each LED there is an indication which identifies the LED as regards the power supply phase to which the LED is dedicated, that is: Yellow LED for Phase "A" of power supply; Green LED for Phase "B" of power supply; Red LED for Phase "C" of power supply.

- Function of outside transmission of the detected impulses. The output connexions "III" & "IV" on DTA-IHXR allow the eventual outside transmission ("passive" mode) of high-frequency impulses, for reading the impulses themselves and adjusting the device. This function is beyond the device's installation purpose which is described in this Manual, that is the monitoring of Outdoor Unit's power consumption. The amplitude of impulses that are sent in "passive" mode is of 80 ± 20%ms.

Figure 2: the 6-digits LED Display of DTA-IHXR.

Note. In the photo above, all display's elements are shown ON for explanation purposes.

3. Dimensional Features of DTA-IHXR.

- Dimensions. Height (A): 280mm. Width (L): 172mm. Depth (P): 80mm.

- Weight. 2.05kg.

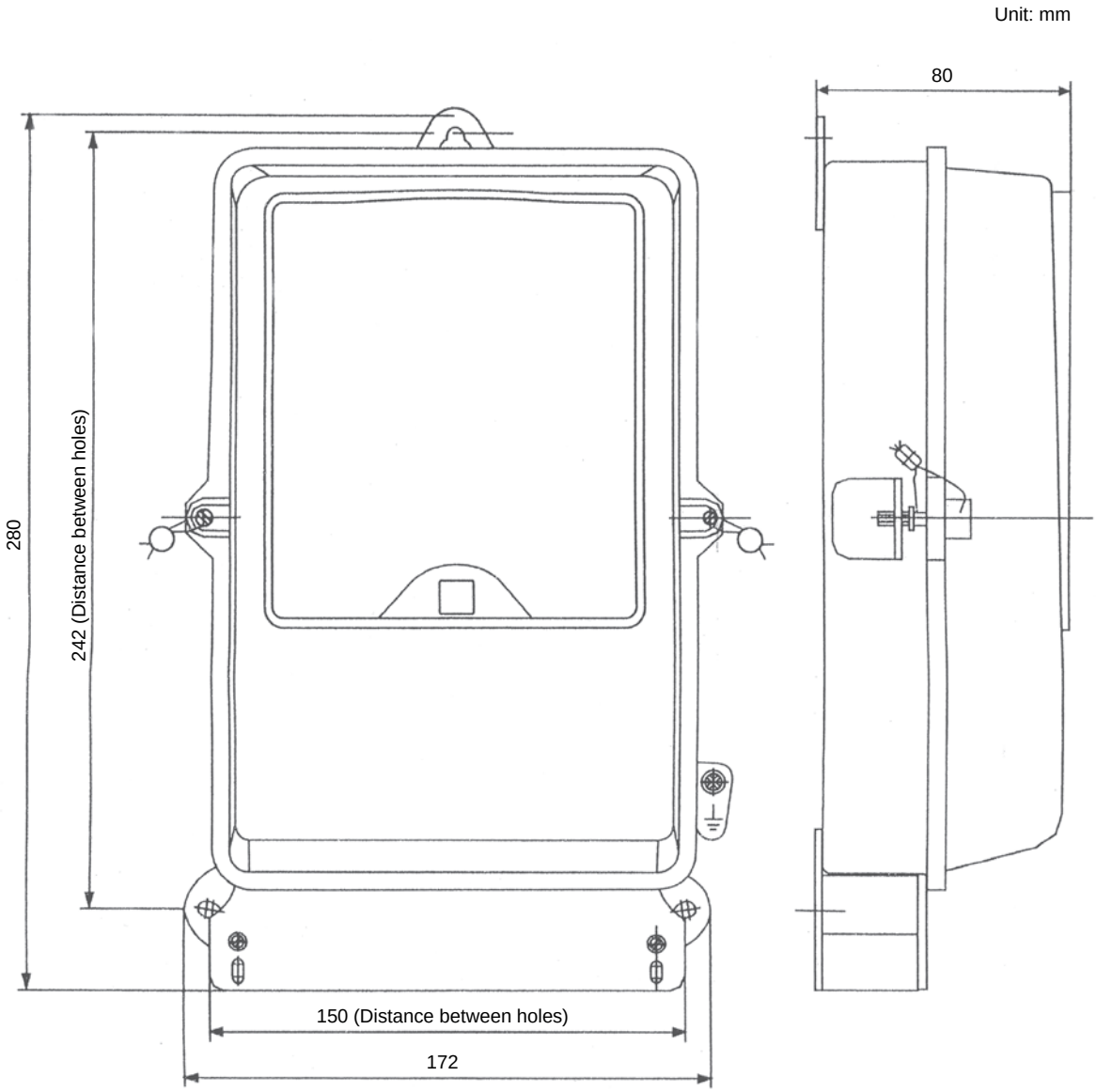


Figure 3: Dimensions of DTA-IHXR and distance between fixing holes.

2. PRODUCT'S INSTALLATION

■ Packing box list

Check whether the assemblies are complete:

1. DTA-IHXR Digital Ammeter.

2. This Installation & Operation Manual.

■ Installation assemblies, not included in the packaging (to be purchased on site)

Before starting the installation, please purchase the following assemblies and material on site:

1. 2-core electric cable for dialogue between DTA-IHXR and Outdoor Unit's PCB, of necessary length and appropriate size according to the length required by installation, for the connexion of DTA-IHXR to Outdoor Unit (contacts "O", "A" on PCB). The recommended min. size for these wires is of 1.0 mm^2.

2. 5-core electric cable (power supply phases "A", "B", "C", Neutral wire and Ground wire) for supplying power to each Outdoor Unit, of necessary length and appropriate size as regards the electric absorption features of Outdoor Unit, also according to the length of wires required by installation.

3. As installation of one or several DTCO-UHXRV Centralized Controllers is required, and it is also required a PC equipped of a BMS-UHXRV Software package (original Software, specific for *"Building Management System"*) with corresponding Hardware (RS-485 ↔ RS-232 Converter):

- 3-core shielded cables, of necessary length and appropriate size (the recommended min. size is 1.0 mm^2) according to type of installation, for connecting the Outdoor Units each other (signal lines "K1, K2, E").
- Only in case of several Outdoor Units that are installed in combination each other: 3-core shielded cables, of necessary length and appropriate size (the recommended min. size is of 1.0 mm^2) according to the type of installation, for connecting the Outdoor Units each other (signal lines "H1, H2, E").
- 3-core shielded cables, of necessary length and appropriate size (the recommended min. size is of 1.0 mm^2) according to the length required by installation, for connecting DTCO-UHXRV Centralized Controllers each other (signal lines "F1, F2, E") and for connexion between the first DTCO-UHXRV and RS-485 ↔ RS-232 Converter.

4. Embedded electric box or electric box at sight, according to the quantity required by installation (according to the number of DTCO-UHXRV Centralized Controllers), provided with screws joints, watertightness.

5. Plastic hard pipes for electric wires, whose length is abl to satisfy installation requirements.

6. Nylon clamps for electric wires, whose quantity is able to satisfy installation requirements.

■ Checks to carry out before starting installation of DTA-IHXR

1. Please check that Product corresponds to what has been ordered:

   • Check whether Product and specifications correspond to what has been ordered.

   • Check whether side seals (copper plaits and lead seal) have not been tampered and that they are intact.

   • If the device does not correspond to what has been ordered, or if device has been tampered, immediately contact the Distributor.

2. Product's package must be intact:

   • If Product's package is visibly damaged because of impacts or anomalous stress during transport, do not install the device and immediately contact the Distributor.

■ Storage and transport of DTA-IHXR

1. Product's package conforms to GB/T15464-1995 Standard.

2. Until the device is in its package, it must be kept in a clean and ventilated room, with relative humidity lower than 85%, so that the metallic components of the device do not corrode.

3. The bearing surface for packaging must be regular and level.

4. Place every packaging with the frontal part upside, and do not superimpose more than 5 packagings.

5. Requirements and regulations concerning transport:

   • Prevent the Product's packaging from impacts or anomalous stress.

   • Never superimpose more than 5 packagings.

   • Never wet the packaging and never place it near heat sources.

   • Product's transport must always take place in accordance with JB/T9329-1999 Standard.

■ **After-Sales Service and Rules for Product's Warranty**

If within 2 years since its delivery date the Product malfunctions, the rules for European Warranty are valid, provided that:

• The Product has not been tampered, and that no seal has been placed on it.

• Transport, storage, installation and use must take place in accordance with GB/T17215-2002 (IEC61036: 2000) Standard and with the instructions contained in this "Installation & Operation Manual".

■ **Variations of Technical Specifications and of Product's appearance**

• Due to on-going technological development of Products and with the purpose to improve Product's quality, the Manufacturer reserve the right to vary the Technical Specifications and the appearance of Product at any time and without notice.

Figure 3: Appearance of plexiglass frontal cover of DTA-IHXR.

■ Instructions for wall installation

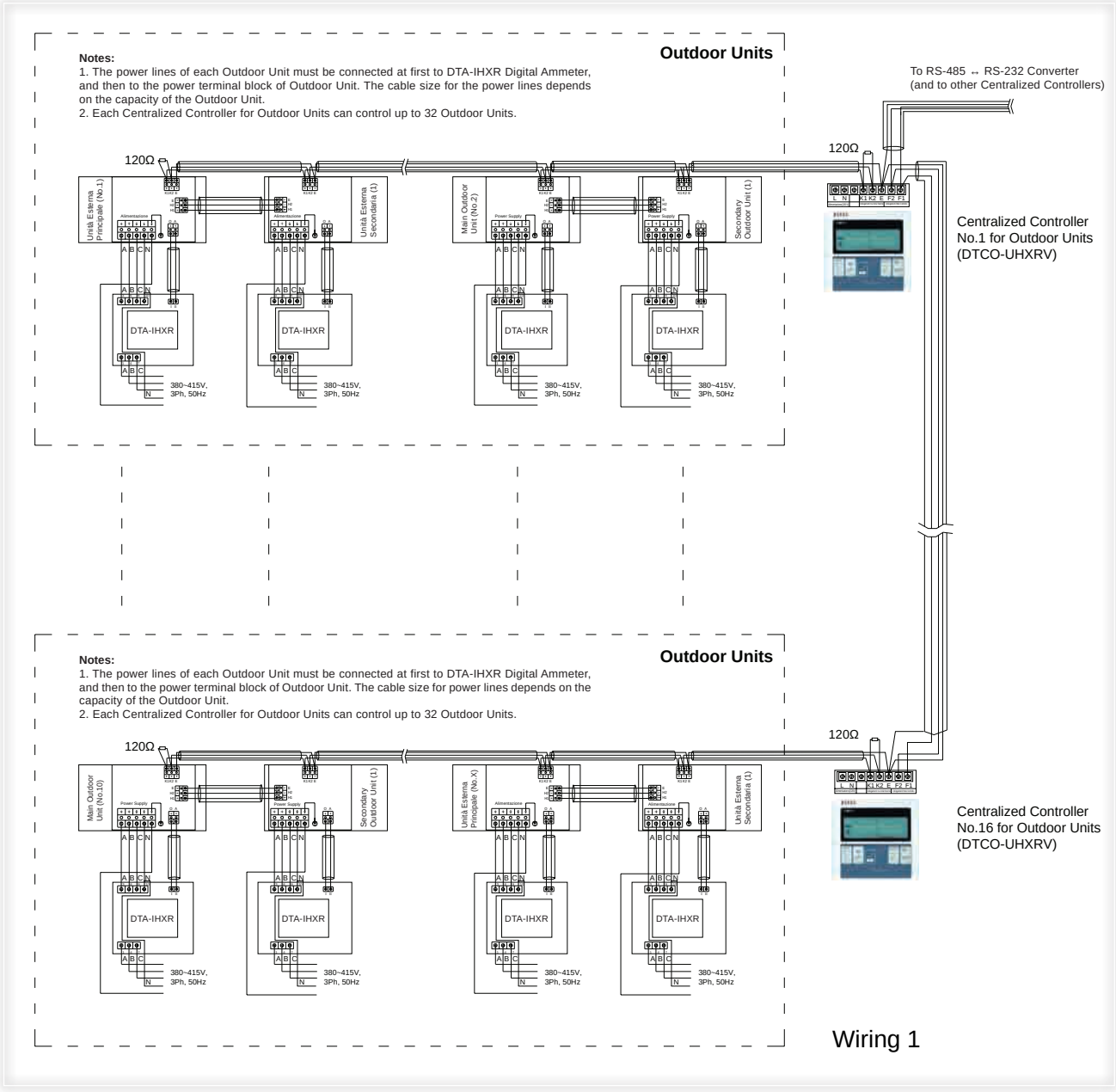
• Install DTA-IHXR device on a strong vertical surface, made of fireproof material.

• Position the device at a height not lower than 1.8 meters as regards the ground.

• For fixing, use 3 screws M4 with screw anchors. The photo below shows the position of the 3 holes for fixing of DTA-IHXR to vertical surface, and the corresponding distance between holes.

Figure 4: Position and distance between holes for installation of DTA-IHXR.

■ Wiring of DTA-IHXR with DTCO-UHXRV Centralized Controllers for Outdoor Units



Wiring 1

Notes.

1. The signal lines "P, Q, E" (between the Indoor Units and the Outdoor Unit), "X, Y, E" (among the Indoor Units, and between the Indoor Units and the Centralized Controller for Indoor Units), "H1, H2, E" (among Outdoor Units installed in combination each other), "K1, K2, E" (among the Outdoor Units, and between the Outdoor Units and the Centralized Controller for Outdoor Units), "F1, F2, E" (between the Personal Computer for "Building Management System", and the Centralized Controllers for Indoor/Outdoor), require the use of shielded cables having a min. size of 1.0mm^2. All wiring has a polarity that must correspond properly. During installation, do not cross-connect cables. The max. allowed length for each signal line is of 1000m.
2. For the survey of the electric consumptions, it is necessary a further connection ("O", "A" lines) between the Outdoor Unit whose electric consumption you would like to calculate, and the optional device DTA-IHXR ("Digital Ammeter") specific only for that Outdoor Unit.
3. Each Personal Computer, through Software-Hardware BMS-UHXRV Package, can manage up to max. 16 Centralized Controllers for Indoor Units, and up to 16 Centralized Controllers for Outdoor Units. Each Centralized Controller for Indoor Units can control up to 64 Indoor Units. Finally, each Centralized Controller for Outdoor Units can control up to 32 Outdoor Units.
4. The parallel installation of 120Ω resistances at each end of signal lines (see the diagram above) is no more strictly required, as in the meantime the capacity anti-interference of the integrated control firmware in the Units (in the EEPROM) has improved.

■ **Removal of DTA-IHXR terminal block cover**

• As it is shown in the photo below, to reach the contacts of terminal block, it is necessary to remove the light colour cover, fixed by 2 cheese-headed and sideways knurled screws.

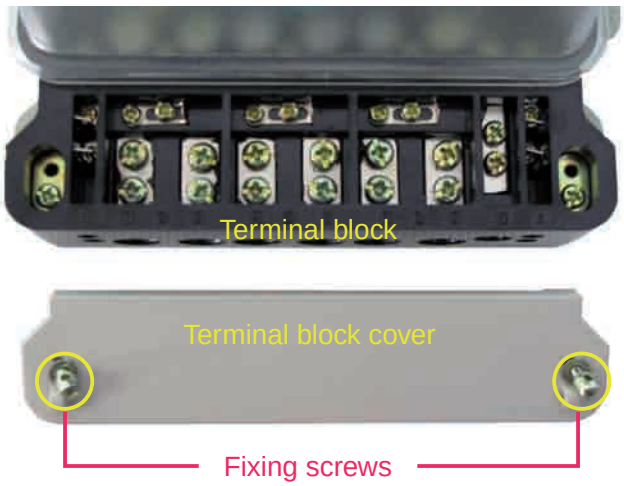


Figure 5: Removing of terminal block cover.

■ **Numbers of contacts on DTA-IHXR's terminal block**

• On the photo below, the numbers of contacts on terminal block is shown, as it is indicated on the device itself.

Figure 6: Numbers of contacts on DTA-IHXR's terminal block.

• For the match between contacts and connections to terminal block of power lines and wires that allow the dialogue between DTA-IHXR and other devices on signal network, see the diagram in the following page.

■ Wiring to terminal block of DTA-IHXR

• Carry out the wiring by observing the following directions carefully.

Diagram 2

Note

• The recommended min. size of wires ("I" ↔ "O" and "II" ↔ "A") for dialogue between DTA-IHXR and Outdoor Unit is of 1.0mm^2.

• The connections to "passive" contacts ("III" and "IV") are not required for power consumption recording of Outdoor Unitdell'Unit, but they only allow to read imlpulses detected by DTA-IHXR, i.e. for an eventual gauging of the device itself.

• The recommended min. size for power supply input and output wires of DTA-IHXR depends on power input features of Outdoor Unit, in addition to the length of power wires. Please refer to Technical Manual of "XRV Systems".

■ **Match between the holes on bottom of DTA-IHXR and contacts on terminal block**

• The photo below helps to find contacts on DTA-IHXR's terminal block as regards the passing holes for dialogue and power wires to be connected to the device.

Figure 8: Match between holes for wires and contacts on terminal block.

CE DECLARATION OF CONFORMITY

We Termal Srl - 14, Via della Salute - 40132 Bologna - Italy

DECLARE UNDER OUR SOLE RESPONSIBILITY

that HOKKAIDO Product "DTA-IHXR Digital Ammeter"

conforms to the following Directives:

- **Electromagnetic Compatibility Directive EMC 2004/108/EC.**
- **Low Voltage Directive LVD 2006/95/EC.**
- **Harmonized Rules: EN 62053-21:2003, IEC 62053-21:2003.**

President
Giorgio Giatti

Notes

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