MANDÍK AHU - Measurement, Control and Regulation System

INSTALLATION

COMMISSIONING

MANDÍK®

ATEX II 2G IIB T4

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This manual is an integral part of the TPM Technical Conditions 088/12 of MANDÍK Air-Conditioning Units.

Table of contents

1 General

The manual uses long names and designations that are abbreviated for further references within the manual:

- MANDÍK Air-Conditioning Unit, hereinafter referred to only as "MANDÍK KJM".
- Measurement and Regulation System of MANDÍK Air-Conditioning Units, hereinafter referred to only as "MANDÍK KJM MaR".

The manual uses graphic symbols to highlight the given facts, and their meaning is as follows:

This symbol draws attention to potential hazardous situation that imminently endangers life or may cause damage to the unit or its part.

This symbol draws attention to danger of electric shock.

This symbol draws attention to important facts related to correct installation, commissioning or maintenance of the unit or its part. Or it may indicate a suggestion or note for installation, commissioning or maintenance.

This manual contains regulations and suggestions for correct installation, commissioning and maintenance of MANDÍK KJM MaR.

These regulations must be thoroughly studied before starting any activity at the unit and they must be subsequently followed. The observance of these regulations is a precondition for correct operation, function and compliance with warranty conditions. The manufacturer shall not assume responsibility for potential damages caused by incorrect use and all risk shall be born by the user.

The manual is intended for persons with valid authorization for servicing activities to heating, ventilation and air-conditioning units and for persons performing electric installation that can be performed only by an authorized person in compliance with generally valid regulations. The manual and the project electric documentation must be available for service and maintenance and it must be situated next to the unit.

MANDÍK KJM MaR can be used only in compliance with the TPM088/12 Technical Conditions. Any other use is forbidden.

Information on changes and updates of the documentation are always available at www.mandik.cz.

Any arbitrary changes in MANDÍK KJM MaR, like switchboard modifications, etc., which have not been approved in advance by MANDÍK, a.s., shall lead to extinction of the warranties provided and extinction of guarantee of safe use and operation.

Before commissioning the MANDÍK KJM, the complete electrical system must be inspected.

MANDÍK, a.s. reserves the right to change this document in case of technical or other innovations, without previous notice.

2 Related documents

Each MANDÍK KJM MaR system is accompanied by the following documents:

- Project documentation of wiring of "MANDÍK KJM Measurement and Regulation System"
- Switchboard test certificate according to Ţ SN 35 7030 and Ţ SN 35 7107
- "MANDÍK KJM Measurement and Regulation System - Installation, Operation, Maintenance" manual
- Warranty card covering the MANDÍK KJM and MANDÍK KJM MaR set
- Certificates of measurement and regulation system (Declaration of Conformity of KJM RXX, EMC and LVD certification)
- Recommended setting of parameters for VLT® Micro Drive FC used with MANDÍK KJM MaR
- Documentation of electric heater, if included in MANDÍK KJM delivery (Inspection Report, EC Declaration of Conformity, Assembly and Operation Regulations, Wiring Diagram)
- Manual for use and setting of frequency converters, if included in MANDÍK KJM
- Instructions for installation of other components, if included in MANDÍK KJM MaR

For other documents see www.mandik.cz:

- Mandík KJM Technical Conditions - TPM 088/12
- Detailed instructions for control and commissioning of measurement and regulation system of SIEMENS Climatix regulator
- Instructions for control of MANDÍK KJM from POL822 room instrument
- Instructions for control of DANFOSS frequency converters - type FC 51
- Instructions for control of DANFOSS frequency converters - type FC 101
- Instructions for control of DANFOSS frequency converters - type FC 102

3 Transport and storage

The MANDÍK KJM MaR switchboards and components are packed in cartons and must be transported as fragile goods.

The MANDÍK KJM MaR switchboards and components must be stored in temperature ranges from -25°C to +60°C, at maximum relative humidity of 85% and simultaneous prevention of condensation. An environment without substances, gases, vapours or dust causing corrosion or other physical or functional changes must be ensured.

4 Installation and assembly

This section includes basic suggestions for work at placement of individual MaR system components. Wrong placement of individual components of the MaR system may lead to bad regulation of the whole air-conditioning system, i.e. the air-conditioning system may not work as required by the technical report or project documentation.

Before assembly, the completeness of the delivery of components and switchboards must be performed against the delivery note.

The individual components of the air-conditioning system must be installed only according to the respective assembly regulations delivered by the manufacturer, including thorough check of condition and function.

The electric wiring can be accomplished only by a worker authorized according to generally valid regulations. Works on or repairs of the air-conditioning unit can be carried out only after switching off the power supply by the main switch! If parts of the air-conditioning unit contain service switches, it is sufficient to switch off the service switch for work at such parts (e.g. fans).

NEVER remove covers or other safety devices and NEVER operate the unit or its parts, if safety measures are ineffective.

The standard MANDÍK KJM MaR switchboards are prepared to be installed in vertical position on a firm base (wall or another firm base with flammability degree A and B according to EN 13501-1). It is recommended to install the switchboard on a firm base in four points, the placement of which is given by the structure of the installation place, with the help of screws and wall plugs.

A different installation (embedding into a wall, embedding into a MANDÍK KJM chamber, etc., ...) is allowed only based on the approved customer's requirement according to the respective order.

Power, control and communication cables can be brought to the switchboard from above and from below based on the order.

Standard switchboards with height above 2000 mm are prepared for installation on the floor or on another sufficiently firm base under the switchboard.

When installing the MaR components, all interventions into the shell and structure of the units must be performed while avoiding damage to the tightness and functionality of individual inbuilt units. Any holes that have been made must be additionally sealed with cement.

4.1 Cables and connection terminals

The MANDÍK KJM MaR switchboards can be connected to TN-S 1x230V+N+PE, TN-S 3x400V+N+PE or TN-C 3x400V+PEN system, based on the customer requirements. Each switchboard has self-standing PE and N connection terminals.

Based on the project documentation of wiring, the L1, L2, L3 terminals are prepared in the XP terminal box and they can be replaced by the terminals of the main switch. Also the other power cables (fans, water heating, electrical heating, gas heating, rotary recuperator, glycol circuit, heat pump, condensing units, etc., ...) are connected to the terminals according to the electrical project documentation.

The other actuators and passive elements of regulation are connected to unambiguously specified terminals according to the electrical project documentation.

The unified system of connection of all MaR components to terminals in control boxes for MANDÍK KJM, including unambiguous assignment of type and number of terminal to the specific regulation elements including the recommended cables, is described in Annex A.

To comply with the requirements of electromagnetic compatibility, the power cables must be routed separately from the operating and control cables, ideally in self-standing trenches at about 100 mm from each other.

The connection must be carried out according to valid standards and in compliance with local safety regulations for wiring.

The cable bars and pipes must be installed so that it does not obstruct access to inbuilt units and possible service of the unit. To pass the cables through the chamber wall, always use bushings or cable terminals with sizes corresponding to the diameter of the cable in use. The cables must be routed to avoid damage to the insulation.

The value of the main switch is always given by the specific MANDÍK KJM system. We recommend to equip the main supply to the MANDÍK KJM MaR switchboard with corresponding overvoltage protection.

The switching capability of front-end protection components of the MANDÍK KJM MaR switchboard must always be verified from the perspective of time of overvoltage of the

supply cable, short-circuit resistance and cut-off time.

4.2 Installation of MaR system components

This section includes basic suggestions for placement of individual MaR system components. Wrong placement of individual components of the MaR system may lead to bad regulation of the whole air-conditioning system, i.e. the air-conditioning system may not work as required by the technical report or project documentation.

The MANDÍK KJM MaR switchboard must be placed so that good access for the operator and sufficient space for maintenance are provided.

When installing the MaR components, all interventions into the shell and structure of the units must be performed while avoiding damage to the tightness and functionality of individual inbuilt units. Any holes that have been made must be additionally sealed with cement.

4.3 Switchboard description

A typical design of the MANDÍK KJM MaR cabinet made of plastic can be seen in the two pictures below.

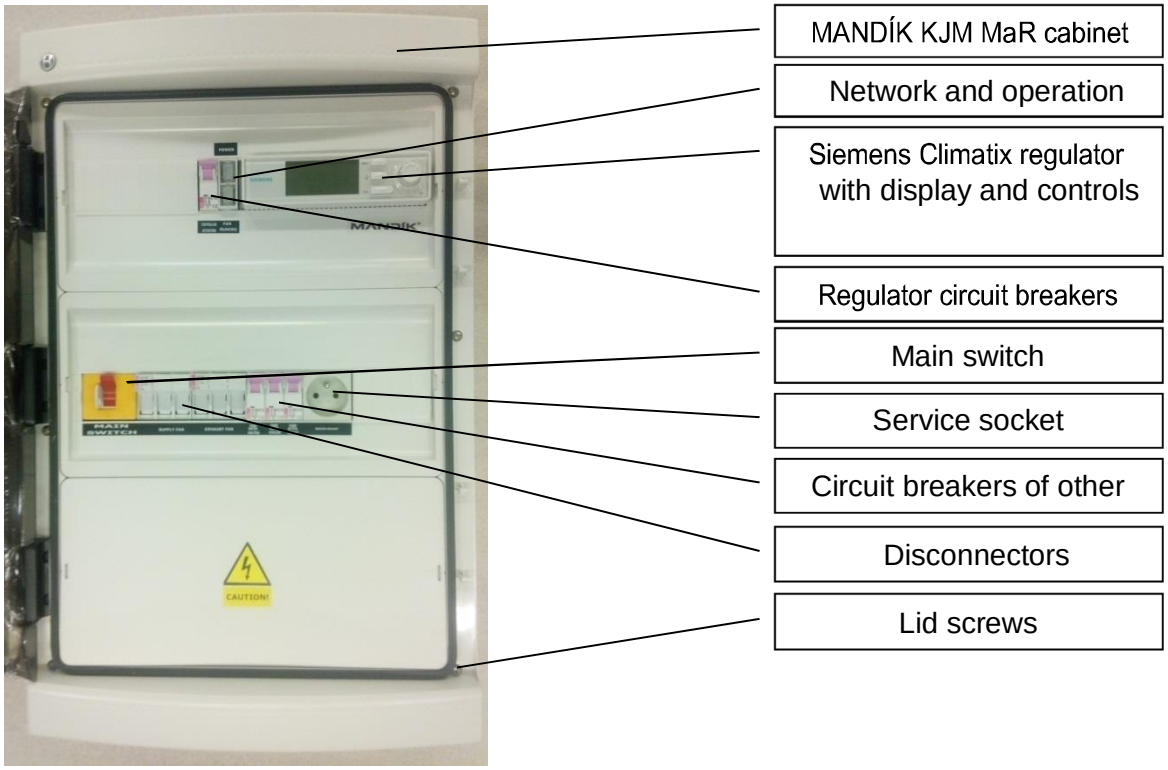


Figure 1 ï Front panel of MANDÍK KJM MaR switchboard with open door

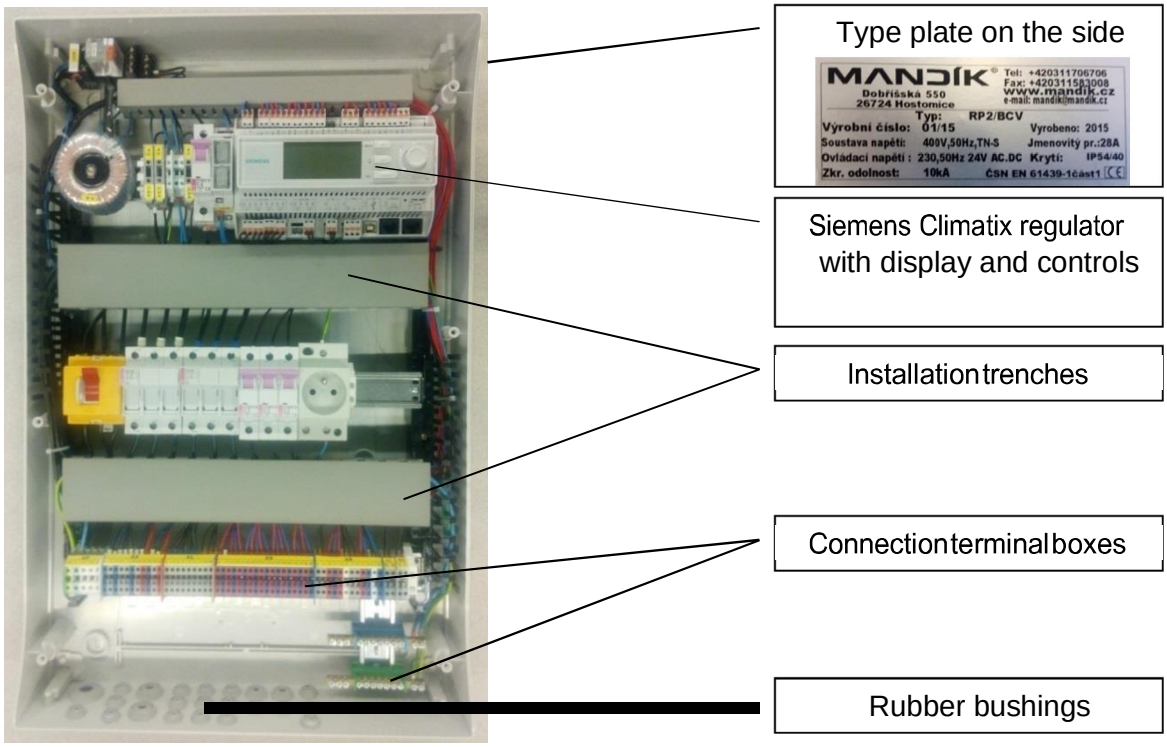


Figure 2 ï Inner arrangement of MANDÍK KJM MaR switchboard

4.4 Temperature detectors

The standard MANDÍK KJM MaR system uses resistance temperature detectors from Siemens, with NTC10k measuring element. If the customer wishes it, temperature detectors from other manufacturers with other measuring elements can be used.

4.4.1 Outdoor temperature

Two types of temperature detectors can be used for measurement of outdoor temperature: outside type QAC2030 or channel type QAM2130.40. The measuring range of QAC2030 detector is ï 50...+70°C. The measuring range of QAM2130.40 detector is ï 40...+ 80°C.

Placement: The QAC2030 outdoor temperature detector must be installed to avoid distortion of the measured temperature by undesirable environment effects. The detector should be placed at a height of 2,5 m at the minimum above ground, oriented to north or north-west and covered against precipitations, frost or direct sunlight. The detector should not be placed under balconies, roof drains, over windows, doors, air-conditioning mouths or other heat sources. To avoid measurement errors caused by air circulation, seal the cable inlet in the detector case.

The QAM2130.40 channel temperature detector can be used in cases where technical reasons make impossible the use of QAC2030 detector. The detector must be placed in the inlet piping before the inlet air flap.

The detector should not be placed in the inlet piping after the inlet flap! The registered temperature corresponds to actual temperature of outside air only if the inlet fan is on. Incorrect placement may cause damage to the air-conditioning unit, e.g. breakdown of water exchanger, at starting the air-conditioning unit.

Installation: The QAC2030 detector consists of a case and a removable cover. The connection terminals are accessible after removing the cover. The cable can be brought either from behind (cabling in the wall) or from below (cabling on the surface). The Pg 11 cable bushing can be screwed on the bushing from below.

The QAM2130.40 detector consists of a plastic case with connection terminal box and a snap-fit removable cover. The cable is brought through the sealing bushing that can be replaced by M16 (IP 54) cable bushing.

The instructions for installation are printed on the package. The detector is connected to XS:19, 20 terminals in the MaR switchboard according to the electrical project documentation.

Figure 3 ï QAC2030 outdoor temperature detector

Figure 4 - QAM21030.40 channel temperature detector

4.4.2 Inlet air temperature

The inlet air temperature is measured by the QAM2130.40 channel temperature detector. The measuring range is -30...125°C.

Placement: The QAM2130.40 is installed in the piping with the help of the mounting flange included in the package. It is placed after the fan, if the fan is situated after the last register (heater or cooler). Otherwise, the detector is mounted after the last register at a distance of 0,5 m at the minimum. The capillary tube is 40 cm long and measures average temperature. Bend it manually to be situated diagonally across the channel cross section, or wind it up so that its coils are regularly distributed across the channel cross section. The capillary tube must not touch the piping walls.

The detector must not be placed freely in the room! The registered temperature would be distorted, not corresponding to actual inlet air temperature, and the regulation quality would be distinctively reduced.

Installation: The detector consists of a plastic case with connection terminal box and a snap-fit removable cover. The cable is brought through the sealing bushing that can be replaced by M16 (IP 54) cable bushing.

The instructions for installation are printed on the package. The detector is connected to XS:3, 4 terminals in the MaR switchboard according to the electrical project documentation.

Figure 5 - QAM21030.40 channel temperature detector including

4.4.3 Room temperature

The room temperature can be measured with the classical QAA2030 room detector or with the POL822 room instrument. The room instrument can be simultaneously used for control of the air-conditioning unit.

Placement: The QAA2030 room temperature detector and the POL822 room instrument are installed on the inner wall of the room to be air-conditioned or heated. They are not to be mounted into recesses, racks, behind curtains, over or under or close to heat sources. They must not be exposed to direct sunlight. Ideal placement of the detectors is at a height of about 1,5 m in the area where persons are present, with a minimal distance of 50 cm from another nearest wall. Besides, the detectors should not be placed on the outer wall, in place with increased air current, behind furniture or in places affected by any heat source, e.g. by light fittings. Seal the installation pipe of the connection cable to avoid additional error of temperature measurement caused by draught.

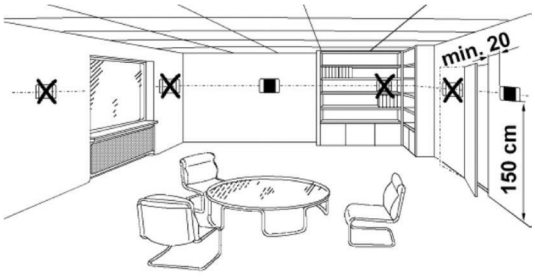


Figure 6 - Placement of room detector

Installation of QAA2030 detector: The detector is intended for installation on the wall. The instrument can be mounted on common installation boxes. The cable can be brought from behind (cabling under the plaster) or from below, or from above (cabling on

the wall) through break-out holes. The instrument consists of two parts: Case and base plate. Both parts are snap-fitted on each other. The terminal box is situated on the base plate.

The instructions for installation are printed on the package. The detector is connected to XS:1, 2 terminals in the MaR switchboard according to the electrical project documentation.

Installation of POL822 room instrument: The POL822 room instrument is intended for partially embedded surface installation into the embedded wiring box. The cable bushing runs through the rear cover. The instrument consists of the front cover with the electronic equipment and the rear cover. The rear cover can be dismounted after releasing the locking mechanism. The front cover contains the printed circuit board, the room temperature detector, the LCD panel and the buttons. The rear cover contains the terminals for connection of a two-core conductor with communication. Both covers are made of plastics.

The instructions for installation are printed on the package. The room instrument is connected to XC:CE+, CE- terminals in the MaR switchboard according to the electrical project documentation.

Figure 7 ï QAA2030 room temperature detector

Figure 8 - POL822 room instrument

4.4.4 Temperature of outlet water of water heating

The temperature of the outlet water of water heating is measured by the QAD36/101 surface temperature detector for measurement of temperature of liquid in piping. The measurement range is -30...125°C. The detector has informative and protective function in the regulation. It informs about the temperature of the outlet water and simultaneously provides for the first degree of protection of the water exchanger.

Placement: The QAD36/101 surface temperature detector is installed on the output neck of the heater (on the return pipe) where the detector can measure correctly the temperature of the outlet water.

The detector must not be placed under and over the piping insulation, to avoid distinctive reduction of regulation quality.

Installation: The detector has a plastic case with arrester cover. The connection terminals are accessible after removing the cover. The cable enters through the Pg11 cable gland. The terminal strip for fixing is suitable for pipe diameters of 15é 150 mm.

The instructions for installation are printed on the package. The detector is connected to XS:11, 12 terminals in the MaR switchboard according to the electrical project documentation.

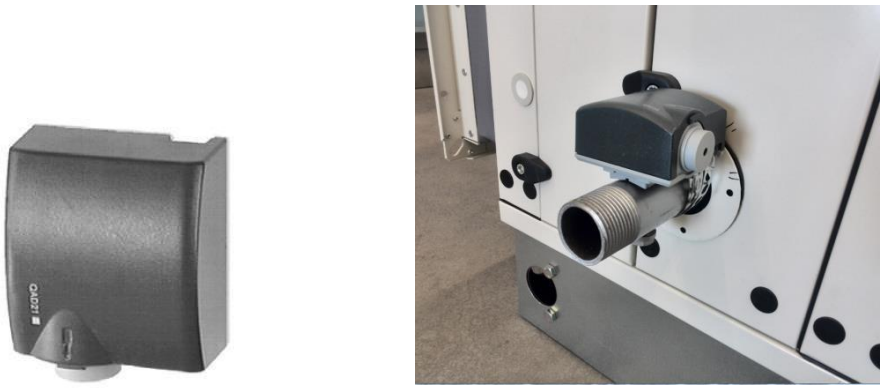


Figure 9 - QAD36/101 surface temperature detector and its installation on the outlet from the water

4.4.5 Flue gas temperature

The temperature of the flue gases is measured by the special QAZ21.5120 cable temperature detector with NI1000 measuring element. The measurement range is -30...200 °C. The detector has regulative and protective function in the regulation. Based on the flue gas temperature, the bypass flap regulates the amount of the air passing through the gas exchanger and, at the same time, provides for the first degree of protection of the gas exchanger against overheating.

Placement: The QAZ21.5120 flue gas temperature detector is to be installed in the sump situated in the exhaust (flue). The detector consists of the measuring piece (diameter 6 mm, length 40,5 mm), the measuring detector and the silicon connection cable. The measuring detector is situated inside the measuring piece; the connection cable is fixed in the piece. The detector is not intended for direct placement (without sump) in the liquid flow.

The detector must be situated so that it is sufficiently bypassed by the flue gases and protected against falling out. Incorrect installation may lead to poor function of gas heating.

Installation: The detector must be situated in the sump placed in the lower part of the flue. It must be sealed with silicone to prevent the detector from falling out. At the same time, the sealing will avoid suction of false air leading to additional error. Connect

the silicon cable with the cable running to the switchboard with the help of the installation box.

The detector is connected to XS:5, 6 terminals in the MaR switchboard according to the electrical project documentation.

Figure 9 - QAZ21.5120 flue gas temperature

Figure 10ï Placement of sump for flue gas

4.4.6 Outlet air temperature

The outlet air temperature is measured by the QAM2130.40 channel temperature detector. The outlet air temperature is used as substitute for room temperature, with the advantage of elimination of local influences on the room temperature. The measuring range is -30...125°C.

Placement: The QAM2130.40 channel temperature detector is installed in the exhaust piping from the room with the help of the mounting flange included in the package. The capillary tube is 40 cm long and measures average temperature. Bend it manually to be situated diagonally across the channel cross section, or wind it up so that its coils are regularly distributed across the channel cross section. The capillary tube must not touch the piping walls.

Installation: The detector consists of a plastic case with connection terminal box and a snap-fit removable cover. The cable is brought through the sealing bushing that can be replaced by M16 (IP 54) cable bushing.

The instructions for installation are printed on the package. The detector is connected to XS:17, 18 terminals in the MaR switchboard according to the electrical project documentation.

Figure 11 - QAM21030.40 channel temperature detector including flange

4.5 Pressure and flow sensors

The standard MANDÍK KJM MaR system uses air differential manostats with digital or analogue output according to the required function. The manostats are used for check of filter clogging, for protection against recuperator freezing or for control of air flow capacity of the fans. The types PS500, PS1500, DPT2500-R8-D, sensors of QBM66 series and flow regulators of CPG-é AV are used as standard, but other types can be used at customer's wish.

4.5.1 Air filter clogging

The measurement range of the filter clogging manostats is designed according to the maximal end pressure loss (according to EN 13053), according to the technical report of the air-conditioning unit and according to the required function. The PS500 differential manostat with switching outlet is intended for one-degree indication of air filter clogging and has a measurement range of 30...500Pa, adjustable by rotary wheel under the lid. The DPT2500-R8-D differential manostat with display and analogue outlet is intended for two-degree indication and has 8 measurement ranges, adjustable by jumpers under the lid, in a total range of -100Pa to 2500Pa.

Placement: The differential manostat and its probes are to be installed on the outer shell of the air-conditioning unit next to the filter to be monitored, so that the inlet hoses are as short as possible and are not mechanically deformed. One probe is to be situated before and the other after the filter.

Installation: The detector consists of a plastic case with connection terminal box, screw-on or snap-fit removable cover, two probes and a PVC hose. The probes must pass through the whole wall of the air-conditioning unit, to allow the manostat to react to the air flowing inside the unit. They must be sealed in order to avoid suction of air through the wall of the air-conditioning unit. The input identified with (+) is to be connected before the filter in the air flow direction**.** The input identified with (-) is to be connected after the filter in the air flow direction**.** The cable is to be brought through the cable bushing.

Figure 12 ï Wiring of manostat inlets and installation on the shell of the air-conditioning

The instructions for installation are included in the manostat package. The manostat of the inlet air filter is connected to the XS:21, 22 terminals and the manostat of the outlet air filter to the XS:31, 32 terminals of the MaR switchboard according to the electrical project documentation.

After the installation, check the correct wiring of the inputs and the passability of the hoses and probes. Inverse wiring of inputs or lack of passability may lead to insufficient amount of the inlet and outlet air at clogged filters, resulting in incorrect function of the whole air-conditioning unit.

Figure 13 – DPT2500-R8-D manostat

Figure 14 – PS500 manostat

4.5.2 Anti-freeze protection of recuperator

The anti-freeze protection of the plate-type or rotatory recuperator is provided by PS500, PS1500 or DPT2500-R8-D differential manostats. The measurement range and the type of the differential manostat are determined based on the pressure loss on the outlet side of the recuperator from the technical specification of the air-conditioning unit. PS500 with measurement range of 30...500Pa or PS1500 with measurement range of 100...1500Pa are used for one-degree indication of recuperator freezing. The required pressure value for indication is to be set by the rotary wheel under the lid. The DPT2500-R8-D differential manostat with display and analogue outlet is intended for two-degree indication and has 8 measurement ranges, adjustable by jumpers under the lid, in a total range of -100Pa to 2500Pa.

Placement: The differential manostat and its probes are to be installed on the outer shell of the air-conditioning unit next to the recuperator, so that the inlet hoses are as short as possible and are not mechanically deformed. One probe is to be situated before and the other after the recuperator on the outlet air side.

Installation: The detector consists of a plastic case with connection terminal box, screw-on or snap-fit removable cover, two probes and a PVC hose. The probes must pass through the whole wall of the air-conditioning unit, to allow the manostat to react to the air flowing inside the unit. They must be sealed in order to avoid suction of air through the wall of the air-conditioning unit. The input identified with (+) is to be connected before the recuperator in the air flow direction**.** The input identified with (-) is to be connected after the recuperator in the air flow direction**.** The cable is to be brought through the cable bushing.

The instructions for installation are included in the manostat package. The manostat of recuperator freezing is connected to XS:29, 30 terminals in the MaR switchboard according to the electrical project documentation.

After the installation, check the correct wiring of the inputs and the passability of the hoses and probes. Inverse wiring of inputs or lack of passability may lead to recuperator freezing and subsequent destruction.

4.5.3 Regulation to constant air pressure

The regulation to constant pressure of the inlet or outlet air is carried out with the help of DPT2500-R8-D differential manostats or with the help of a type from the QBM66 series. The measurement range and the resulting type of the differential manostat are to be determined based on the total transport pressure of the inlet or outlet air fan from the technical specification of the air-conditioning unit.

Placement: The differential manostat and its probes are to be installed on the outer shell of the air-conditioning unit next to the fan, so that the inlet hoses are as short as possible and are not mechanically deformed. One probe is to be situated before and the other after the fan.

Installation: The detector consists of a plastic case with connection terminal box, screw-on or snap-fit removable cover, two probes and a PVC hose. The probes must pass through the whole wall of the air-conditioning unit, to allow the manostat to react to the air flowing inside the unit. They must be sealed in order to avoid suction of air through the wall of the air-conditioning unit. The input identified with (-) is to be connected after the fan in the air flow direction**.** The input identified with (-) is to be connected before the fan in the air flow direction or remain unconnected (open to the atmosphere)**.** The cable is to be brought through the cable bushing.

The instructions for installation are included in the manostat package. The manostat of constant pressure is connected to XS:55, 56, 57 terminals in the MaR switchboard according to the electrical project documentation.

4.5.4 Regulation to constant air amount

The regulation to constant amount of the inlet or outlet air is carried out with the help of the CPG-...AV... differential pressure regulator. The measurement range and the resulting type of the differential pressure regulator are to be determined based on the air flow of the inlet or outlet air fan from the technical specification of the air-conditioning unit in m3/h.

Placement: The differential flow regulator and its probes are to be installed on the outer shell of the air-conditioning unit next to the fan, so that the inlet hoses are as short

as possible and are not mechanically deformed. One probe is to be situated before and the other after the fan.

Installation: The detector consists of a plastic case with connection terminal box, screw-on removable cover, two probes and a PVC hose. The probes must pass through the whole wall of the air-conditioning unit, to allow the manostat to react to the air flowing inside the unit. They must be sealed in order to avoid suction of air through the wall of the air-conditioning unit. The input identified with (+) is to be connected before the fan in the air flow direction**.** The input identified with (-) is to be connected after the fan in the air flow direction**.** The cables are to be brought through cable bushings.

The detailed instructions for installation and parameter setting are included in the flow regulator package. The constant flow regulator is connected directly to the control terminals of the frequency converter according to the electrical project documentation.

Figure 15 ï Air amount regulator CPG-é AV

4.6 Other detectors and sensors

Other sensors include air quality (humidity and pollution) sensors and fire or smoke detectors.

4.6.1 Air humidity

The QFA2000 relative humidity room detector or the QFM2100 relative humidity channel detector are used for humidity monitoring as standard. Other types, e.g. combined with temperature detector, can be used at customer's wish.

Placement of QFA2000: The relative humidity room detector is to be installed on the inner wall of the air-conditioned or ventilated room. It is not to be mounted into recesses, racks, behind curtains, over or under or close to heat sources. It must not be exposed to direct sunlight. Ideal placement of the detector is at a height of about 1,5 m in the area where persons are present, with a minimal distance of 50 cm from another nearest wall. Besides, the detector should not be placed on the outer wall, in places with increased air current, behind furniture or in places affected by any heat source, e.g. by light fittings.

Installation of QFA2000: The detector is intended for installation on the wall. The instrument can be mounted on common installation boxes. The cable can be brought from behind (cabling under the plaster) or from below, or from above (cabling on the wall) through break-out holes. The instrument consists of two parts: Case and base plate. Both parts are snap-fitted on each other. The terminal box is situated on the base plate.

The detailed instructions for installation and parameter setting are included in the package. The humidity detector is connected to XS:41, 42, 43 terminals in the MaR switchboard according to the electrical project documentation.

Placement of QFM2100: The relative humidity channel detector is to be installed in the outlet air piping with the help of the mounting flange included in the package. The measuring elements are situated at the end of the measuring pipe and protected by a bushing with a filter. The measuring tube must not touch the piping walls.

Installation of QFM2100: The detector consists of a plastic case and a snap-fit removable cover. The electronic circuit and the setting elements on the printed circuit board are inside the case together with the connection terminal. The detector is to be fixed with screws or the mounting flange. The cable is to be brought through the M16 (IP 54) cable bushing.

The detailed instructions for installation and parameter setting are included in the package. The detector is connected to XS:41, 42, 43 terminals in the MaR switchboard according to the electrical project documentation.

Figure 16 ï QFA2000 humidity room detector

Figure 17 ï QFM2100 humidity channel detector

4.6.2 Air pollution

The CO2 QPA2000 room detector, the CO2 QPM2100 channel detector, the VOC QPM1100 channel detector or the ADS-SMOKE-24 cigarette smoke detector are used for air pollution monitoring as standard. Other types, e.g. combined with temperature detector, can be used at customer's wish.

Placement of QPA2000: The CO2 room detector is to be installed on the inner wall of the air-conditioned or ventilated room. It is not to be mounted into recesses, racks, behind curtains, over or under or close to heat sources. It must not be exposed to direct sunlight. Ideal placement of the detector is at a height of about 1,5 m in the area where persons are present, with a minimal distance of 50 cm from another nearest wall. Besides, the detector should not be placed on the outer wall, in places with increased air current, behind furniture or in places affected by any heat source, e.g. by light fittings.

Installation of QPA2000: The detector is intended for installation on the wall. The instrument can be mounted on common installation boxes. The cable can be brought from behind (cabling under the plaster) or from below, or from above (cabling on the wall) through break-out holes. The instrument consists of two parts: Case and base plate. Both parts are snap-fitted on each other. The terminal box is situated on the base plate.

The detailed instructions for installation and parameter setting are included in the package. The humidity detector is connected to XS:81, 82, 83 terminals in the MaR switchboard according to the electrical project documentation.

Placement of QPM2100: The relative humidity channel detector is to be installed in the outlet air piping with the help of the mounting flange included in the package. The measuring elements are situated at the end of the measuring pipe and protected by a bushing with a filter. The measuring tube must not touch the piping walls.

Installation of QPM2100: The detector consists of a plastic case and a snap-fit removable cover. The electronic circuit and the setting elements on the printed circuit board are inside the case together with the connection terminal. The detector is to be fixed with screws or the mounting flange. The cable is to be brought through the M16 (IP 54) cable bushing.

The detailed instructions for installation and parameter setting are included in the package. The detector is connected to XS:81, 82, 83 terminals in the MaR switchboard according to the electrical project documentation.

Figure 18ï QPA2000 room detector

Figure 19ï QPM2100 channel detector

Placement of QPM1100: The VOC gas mixture channel detector is to be installed in the outlet air piping with the help of the mounting flange included in the package. It serves to indicate the existence of smells in the air-conditioning piping, including tobacco smoke, body smells, vapours from materials, etc. The measuring elements are placed at the end of the measuring pipe and protected by a bushing with filter. The measuring tube must not touch the piping walls.

Installation of QPM1100: The detector consists of a plastic case and a snap-fit removable cover. The electronic circuit and the setting elements on the printed circuit board are inside the case together with the connection terminal. The detector is to be fixed with screws or the mounting flange. The cable is to be brought through the M16 (IP 54) cable bushing.

The detailed instructions for installation and parameter setting are included in the package. The detector is connected to XS:77, 78, 79 terminals in the MaR switchboard according to the electrical project documentation.

Figure 20 ï QPM1100 VOC channel detector

Placement of ADS-SMOKE-24: The ADS-SMOKE-24 room detector shows high sensitivity to low concentrations of low pollutants present in cigarette smoke. It is to be installed on the inner wall of the ventilated room. It is not to be mounted in recesses, racks, behind curtains, etc. Ideal placement of the detectors is at a height of about 1,5 m in the area where persons are present.

Installation of ADS-SMOKE-24: The detector consists of a plastic case and a snap-fit removable cover. The electronic circuit and the setting elements on the printed circuit board are inside the case together with the connection terminal. The detector is intended for partially embedded surface installation into the embedded wiring box. The cable passes through the rear cover. Both covers are made of plastics.

The detailed instructions for installation and parameter setting are included in the package. The detector is connected to XS:67, 68, 69, 70 terminals in the MaR switchboard according to the electrical project documentation.

Figure 21 ï ADS-SMOKE-24 room detector

4.6.3 Fire protection

The basic method of fire protection of the air-conditioning unit and piping consists in cooperation with the electric fire alarm system (EPS) implemented by the EPS switchboard. Another possible fire protection consists in the use of the VDK-10 ionization smoke detector, intended for automatic shutdown of the air-conditioning unit when products of combustion are sucked in.

EPS system: It is a set of devices for sound and optical indication of the centre of the fire. The EPS device is intended for timely indication of fire. It allows controlling the respective technological devices in the premises serving against fire propagation or for fire extinguishing, which in most cases leads to shutdown of the air-conditioning unit. The EPS device is a standard tool in the general fire protection of the premises.

Connection of EPS: The MANDÍK KJM MaR has an input and an output prepared for cooperation with EPS. The output (switched contact) can announce the operation of the air-conditioning unit to EPS at XR:52, 53 terminals. To allow the operation of the air-conditioning unit, a switched potential-free contact must be brought from EPS to XS:73, 74 terminals. For further information regarding the cooperation of EPS with external devices see the EPS documentation.

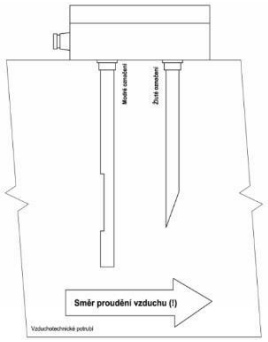
Placement of VDK-10: The detector is to be installed on the side of fresh air inlet after the filter. It must be correctly oriented with respect to the air flow according to the drilling and installation diagram. The device must be placed in a straight part of the HVAC piping in the middle of the top or side of the air duct. It should not be placed on the bottom.

Installation of VDK-10: The detector consists of a plastic box with high protection, to be installed outside the HVAC piping. Two sampling tubes are inserted in the piping; they take air samples during operation of the air-conditioning unit to the smoke detector situated inside the plastic box. Drill the respective holes in the HVAC piping for the sampling tubes according to the drilling diagram. Place the sampling tubes into the cable terminals in the detector box according to the installation diagram (observe the position marked with blue and yellow marks; the upper edge of the black mark must be aligned with the edge of the cable terminal); tighten well the cable terminals and screw the whole

assembly on the HVAC piping. Pay attention to the tightness of the box, cable terminals (including the cable) and to the sealing of the holes for the sampling tubes.

The detailed instructions for installation and parameter setting are included in the package. The VDK-10 detector is connected to XS:46, 47, 48, 49 terminals in the MaR switchboard according to the electrical project documentation.

If the installation requirements are not observed, the air-conditioning unit will not be automatically switched down in case of a fire!



(Směr proudění vzduchu = Air flow direction)

Figure 22 – Diagram of installation of VDK-10 smoke detector

4.7 Servo-drives

The MANDÍK KJM MaR uses the Belimo servo-drives. The servo-drives are used in the air-conditioning units to control the flaps or valves. The drive type is designed based on the necessary control moment and on the required function:

- Servo-drives with continuous control 0-10 V (2-10 V) are used in flap chambers and in flaps of end walls, in plate-type recuperation, in gas exchangers with bypass flap or for valves of mixing nodes.
- Servo-drives with open/closed control are used for flaps of end walls, unless the air-conditioning unit contains a flap chamber.
- Servo-drives with emergency function are used in air-conditioning units primarily for flaps of end walls that must be closed in case of power failure. That avoids access of outside air to the air-conditioning unit and subsequently into the room.

Installation: The electrical installation requires the installation box for interconnection of the servo-drive cable and the MaR cable. For detailed description see the „MANDÍK KJM Installation, commissioning and maintenance" manual, section „5.28 Installation of servo-drives"; further information on installation and electrical wiring of the servo-drive can be found in the manufacturer's instructions included in the package.

4.8 Fans

Two types of electric motors are used to drive the fans:

- Three-phase asynchronous electric motors with cage rotor.
- EC motors.

If the fan chambers are fitted with service switches, the switches must be used at each maintenance or servicing activity.

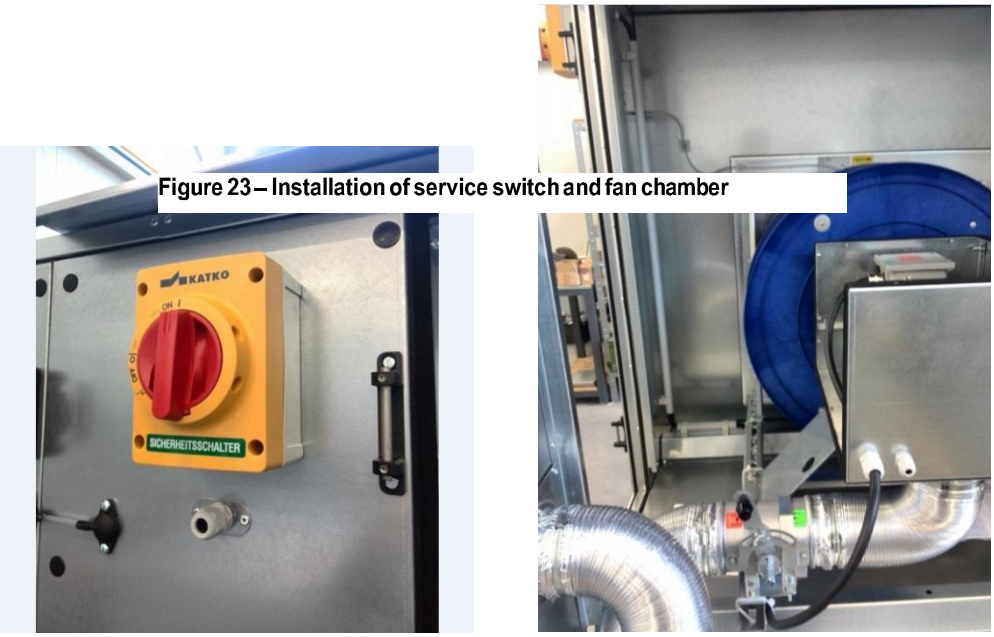


Figure 23 – Installation of service switch and fan chamber

4.8.1 Frequency converters

The three-phase asynchronous electric motors with cage rotors are powered by 3x400V/50Hz. When the motor label has nominal identification: 230V D/ 400V Y 50 Hz, the motor must have star connection; when the nominal identification is: 400V D/690V Y, 50 Hz, the motor must have delta connection. All information needed is stated on the motor label and on the terminal box lid. The motors should be powered by the frequency converter adjusted according to the label values of the electric motor with sufficient startup time.

MANDÍK KJM uses Danfoss, FC type series frequency converters of different capacities to regulate the fan speed. They are controlled from MANDÍK KJM MaR through the control terminal box as standard, according to the electrical project documentation.

Placement: The standard frequency converters are prepared for installation in vertical position on firm base (wall of air-conditioning unit, wall or another firm base with flammability degree A and B according to EN 13501-1); sufficient space for maintenance and service must be left. Further, the frequency converters may be placed by the manufacturer in the MaR switchboard or in the chamber of the air-conditioning unit.

Installation: When installing the frequency converters outside the MaR switchboard, you must strictly observe the instructions stated in the manual delivered

together with the frequency converter by the manufacturer, as well as the local and national directives and safety regulations. The frequency converter is connected to the relevant terminals in the MaR switchboard according to the electrical project documentation. Before the first commissioning, the parameters of the frequency converter must be set according to the ŏRecommended parameter setting for VLT® Micro Drive FCñtable, included in the technical specification of MANDÍK KJM as its integral part. An example of the recommended parameter setting can be found in Annex B.

The correct procedure to ensure conformity of the installation with the requirements of electromagnetic compatibility (EMC) is described in the manual delivered together with the frequency converter by the manufacturer. Suggestions for correct installation from EMC perspective are also described in the ŏMANDÍK KJM Installation, commissioning and maintenanceñmanual in ŏAnnex D. Wiring according to Directive 2004/108/EC ï EMCñ

Avoid accidental start. If the frequency converter is connected to the mains, the motor may be started or stopped by digital commands, terminal box commands, required values or through the control panel.

ŏAnytime the accidental start of any motor should be avoided in order to ensure personal safety, unplug the frequency converter from the mains.

ŏTo avoid accidental start, always press the [OFF] button before changing any parameters.

The voltage of the frequency converter is dangerous after connection to the mains. Wrong installation of the motor or of the frequency converter may damage the unit or cause serious injury or death. It is therefore indispensable to proceed strictly according to the instructions described in the manufacturer's manual and to the local and national directives and safety regulations.

4.8.1 EC motors

EC motors are electronically commuted three-phase synchronous motors. They have an integrated voltage transformer to control the motor speed by an electrical signal. All control and protection functions are integrated in the control unit situated in the fan motor ï only the 1~230V/50HZ or 3~400V/50Hz power supply and the control signal of 0-10V are to be connected. All information needed is stated on the motor label. The EC motor is connected to the relevant terminals in the MaR switchboard according to the electrical project documentation.

Avoid accidental start. If the EC motor is connected to the mains, the motor may be started or stopped by digital commands, terminal box commands, required values or through the control panel. Anytime the accidental start of any motor should be avoided in order to ensure personal safety, unplug the EC motor from the mains.

Wrong installation of the EC motor may damage the unit or cause serious injury or death. It is therefore indispensable to proceed strictly according to the instructions described in the manufacturer's manual and to the local and national directives and safety regulations.

4.9 Rotary recuperator

The motor of the rotary recuperator of MANDÍK KJM is powered by Danfoss, FC type series frequency converters with a capacity of 0,37kW. They are controlled from MANDÍK KJM MaR through the control terminal box as standard, according to the electrical project documentation.

The placement and installation must observe the same rules, recommendations and safety regulations as the fan frequency converters, see section "4.8.1 Frequency converters".

4.10 Water heater

The water heater consists of the exchanger, mixing node, anti-freeze protection and outlet water temperature detector.

4.10.1 Mixing node

The installation is carried out according to the delivered instructions. You must primarily pay attention to the correct position of the pump; the shaft must be placed horizontally. The exchanger necks should be equipped with automatic bleed valves. So called bypass for circulation of the heating liquid should be installed before the mixing node. It is useful particularly at great distances from heat sources (boiler room, exchanger, etc.). The setting of the circulation pump is to be made according to the table in the pump instructions.

Outside installations should have the mixing node placed in the chamber intended for it. The distance between the regulation node and the exchanger should be as short as possible. The maximum is about 4-5 m, in view of potential transport delay of the liquid.

The electric wiring off the pump and of the valve servo-drive is to be carried out according to the electrical project documentation. The pump is to be connected to XL:7, N, PE terminals; the valve servo-drive is to be connected to XA:25, 26, 27 terminals, and the outlet water temperature detector is to be connected to XS:11, 12 terminals in the MaR switchboard.

If the water heating circuit is drained for some reasons, the pump must be disconnected. MaR cranks the pump periodically in order to prevent the bearings from jamming, and if the heating liquid is missing, the pump bearings might be permanently damaged.

4.10.2 Anti-freeze protection

When the water heater is used, the capillary anti-freezing thermostat TS1-C0P is used as standard.

Placement: The anti-freezing thermostat must be installed directly in the chamber of the hot water exchanger.

Installation: The detailed instructions for installation and parameter setting are included in the package. The capillary tube must be regularly unrolled after the exchanger in the air flow direction. The recommended setpoint limit temperature of the thermostat is +5°C. The thermostat contact will switch at an ambient temperature above 5°C; otherwise, it is switched off. The thermostat is connected to XS:25, 26 terminals in the MaR switchboard according to the electrical project documentation.

The capillary tube must be installed with increased caution to avoid its damage and leakage of its charge. The minimal bending radius is about 50 mm.

Figure 24 ï Installation of capillary tube of TS1-C0P anti-freezing thermostat

4.11 Gas heater

The gas heater is delivered in two variants, Monzun and Pecín. It consists of an exchanger, gas burner, emergency thermostat, and outlet flue gas temperature detector. The bypass flap is optional.

The gas burner must not be switched on without simultaneous operation of the supply fan!

4.11.1 Monzun gas heater

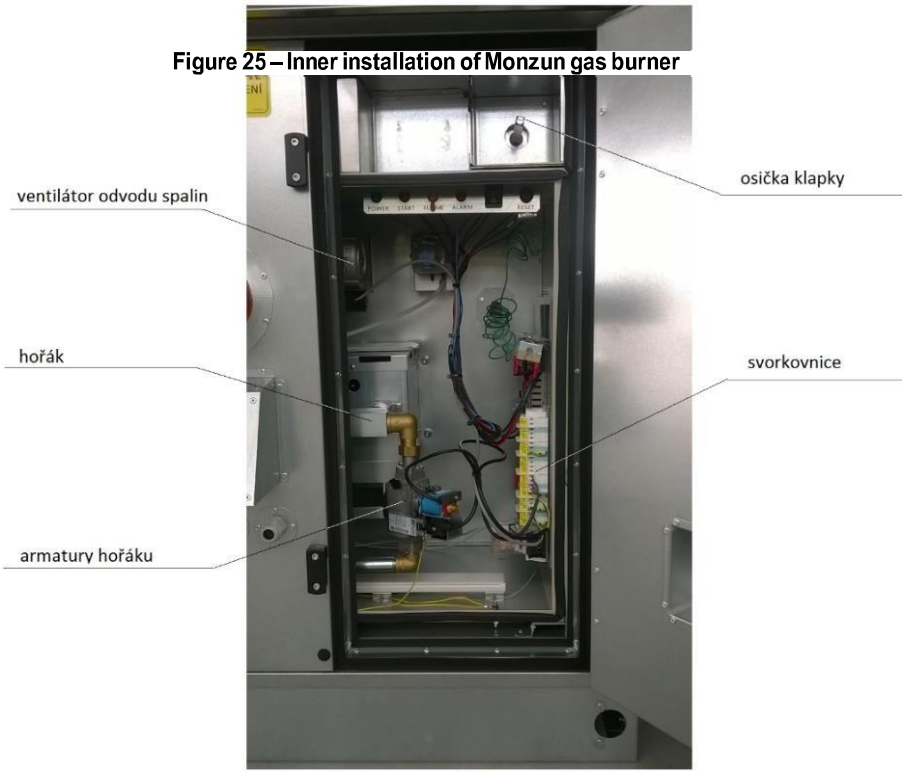
Monzun is a compact gas heater. At the operator's side, there is a door or a removable panel allowing access to the burner, to the ignition automatic system, as well as to clean and check the exchanger and to install the servo-drive of the bypass flap. The emergency thermostat is included in the wiring inside the heater. Next to the removable panel, there are cable bushings prepared above the gas connection pipe.

The installation, service and maintenance must be performed strictly according to the instructions of the ĂMANDÍK KJM Installation, commissioning and maintenanceń manual, section Ă5.16 Monzun gas heater chamberń.

The control and regulation of the automatic system of the Monzun burner is connected to the XL:52, 53, 54, 55, N, PE terminals and to XR:45, 46 terminals in the MaR switchboard. The bypass flap is connected to the XA:17,18,19 terminals and the flue gas temperature detector is connected to the XS:5,6 terminals. All that according to the electrical project documentation.

All expert works must be performed only by a service technician with adequate certificate from MANDÍK,a.s.

Figure 25 – Inner installation of Monzun gas burner



Translation of the mentioned designations:
ventilator odvodu spalin = **flue outlet fan**, osiļ ka klapky = **flap spindle**, hoŚák = **burner**, svorkovnice = **terminal box**, armatury hoŚáku = **burner fixtures**

4.11.2 Pecín gas heater

The standard Pecín gas heater uses Elco or Weishaupt compact burners, situated in the burner cover fixed to the chamber in outside installations. The cover can contain a socket for the electric convector warming up the burner to a temperature of +4°C if the air-conditioning unit is off. The cover has a removable panel allowing access to the burner and containing the prepared cable bushings.

The emergency capillary thermostat is delivered in a self-standing plastic box identified as RHT, together with the thermostat capillary tube holder. The emergency thermostat must be placed with utmost care according to Figure 27. The RTH plastic box is usually placed on the wall of the gas heater.

The installation, service and maintenance must be performed strictly according to the instructions of the ĂMANDÍK KJM Installation, commissioning and maintenanceń manual, section Ă5.15 Pecín gas heater chamberń.

The control and regulation of the automatic system of the Pecín burner is to be connected to the XL:10, 11, 12, 13, 14, 15, 16, 17, 18, N, PE terminals in the MaR switchboard. The standard socket for the electric convector is to be connected to the XL:47,N,PE terminals. Some burner types have power supply separated from control. One-phase power supply is connected to the XL:52, N, PE, terminals; three-phase power supply is connected to the XL:BL1, BL2, BL3 terminals. The bypass flap is connected to the XA:17, 18, 19 terminals, and the flue gas temperature detector is connected to the XS:5, 6 terminals. All that according to the electrical project documentation.

The installation must be carried out only by a qualified technician authorized to work with gas equipment and exclusively in compliance with the manufacturer's instructions.

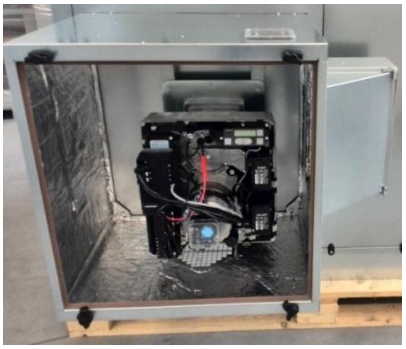


Figure 26 ï Inner installation of Pecín gas burner

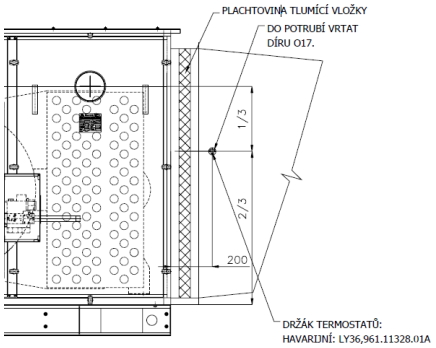


Figure 27 - Placement of emergency thermostat

Translation of the mentioned designations: **plachtovina tlumící vloģky** =cover of the insulation, do potrubí vrtat díru O17 = **drill a hole size O17 in the ductwork**, drģák termostatŢ = **thermostat holder,** havarijní = **emergency**

4.12 Electric heater

The standard electric heater is controlled by the SSR relay through pulsewidth modulation. The SSR regulation can be in external or internal model in the MaR switchboard. The electric heater includes an operation and emergency thermostat.

The installation, service and maintenance must be performed strictly according to the instructions of the ĂMANDÍK KJM Installation, commissioning and maintenanceń manual, section Ă5.14 Electric heater chamberń.

The power supply of electric heating is to be connected to the XL:21, 22, 23, PE terminals, and the thermostats are to be connected to the XL:19, 20 terminals. The pulse modulation control is to be connected to XR:19, 20 terminals. All that according to the electrical project documentation.

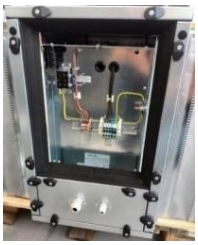


Figure 28 ï Inner installation of electric heating

The electric heating must not be switched on without simultaneous operation of the fan!

4.12 Water cooler

The water cooler consists of the exchanger and the mixing node. The installation of the mixing node is carried out according to the delivered instructions. You must primarily pay attention to the correct position of the pump; the shaft must be placed horizontally. The setting of the circulation pump is to be made according to the table in the pump instructions.

The distance between the regulation node and the exchanger should be as short as possible. The maximum is about 4-5 m, in view of potential transport delay of the liquid.

The electric wiring off the pump and of the valve servo-drive is to be carried out according to the electrical project documentation. The pump is to be connected to the XL:33, N, PE terminals and the valve servo-drive is to be connected to the XA:29, 30, 31 terminals in the MaR switchboard.

If the water heating circuit is drained for some reasons, the pump must be disconnected. MaR cranks the pump periodically in order to prevent the bearings from jamming, and if the heating liquid is missing, the pump bearings might be permanently damaged.

5. Commissioning

The commissioning of the unit must be carried out only by a qualified and trained person. The following checks must be performed before the actual startup:

- Check whether all service switches of the motors and other devices are off; check whether the main switch, the disconnectors and the circuit breakers in the MaR switchboard are off.
- Check the interior of the device; clean if polluted.
- Check the completeness and availability of the documentation delivered together with MANDÍK KJM, including MaR documentation.
- Based on the electrical project documentation, check the MaR system:
  - Check the attachment of temperature detectors, manostats and other operation or emergency protections.
  - Check the attachment of fans, filters, exchangers, heaters, filters and other components of the air-conditioning unit.
  - Check whether the cables comply with the requirements concerning protection, cross section and way of placement.
  - Special attention must be paid to the check of the conductive connection of all parts of the air-conditioning unit and the related devices.
- Special care must be devoted to the conductive connection of all parts of the air-conditioning unit including accessories.

Before commissioning, the initial inspection of the electrical equipment must be documented!

The main switch of the MaR system switchboard can be switched on after the inspections and checks. The green LED indicating power supply to the switchboard must shine. Then the individual circuit breakers and disconnectors in the MaR system switchboard can be gradually switched on.

Subsequently, check on the initial screen of the Climatix regulator that the Manual control and the Off mode are chosen, to avoid start of the unit before checking the functionality of the individual components of MaR and MANDÍK KJM.

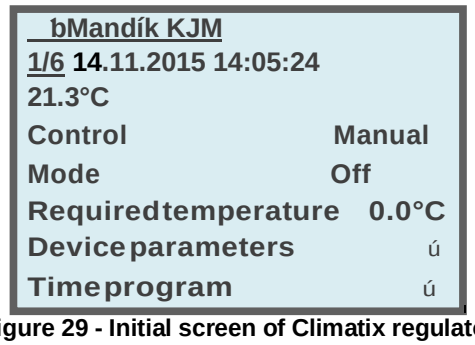


Figure 29 - Initial screen of Climatix regulator

5.1 Basic settings of Climatix regulator

The MANDÍK KJM MaR switchboard is manufactured according to the technical specification and customer or project requirements. Based on those requirements, the configuration and operation parameters are set in the Climatix regulator in the factory, so that the regulator is ready for operation with the respective MANDÍK KJM upon correct connection and function of the other components.

At commissioning, the authorized employee must always check and possibly adjust the parameters for the actual operation of the air-conditioning unit according to the specific operation conditions of the building and according to the modifications that have possibly been carried out during the installation of the air-conditioning units and of other devices. The individual parameters and their potential modifications are described in the "Detailed instructions for control and commissioning of measurement and regulation system of SIEMENS Climatix regulator". Important parameters affecting the behaviour of the regulation, e.g. configuration parameters, regulation constants, correction values, operation parameters or functions can be changed only after entering the password. The password must be entered in the ***Device parameters*** Q ***Enter password*** menu. The password set from the factory is ***0000***. The correctly entered password is indicated in the upper left corner of the regulator display by a zero.

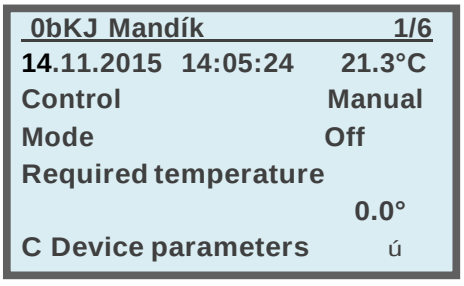


Figure 29 - Initial screen of Climatix regulator with correctly entered password

At switching the MaR for the first time, a failure can be indicated by a bell in the upper right corner of the regulator display. The failure can be caused by incorrect connection of some components.

If a failure occurs at commissioning, never switch the mode to other status than Off. The failure will be eliminated during the checks and settings described below.

A more comfortable variant of the Climatix regulator control consists in PC control through a web browser. The necessary procedure is described in the "Detailed instructions for control and commissioning of measurement and regulation system of SIEMENS Climatix regulator".

5.2 Settings and checks of frequency converter functions

After the initial inspection and after switching on the main switch of the MaR switchboard including the frequency converter disconnectors, the frequency converters must be adjusted according to the parametrization sheet included in the electrical project documentation. It is always useful to switch on only the disconnector of the frequency converter that is to be parametrized. The function of the buttons on the frequency converter and the parametrization procedure are described in detail in the documentation enclosed to the frequency converter from the manufacturer. During the parametrization, the frequency converter must be in Off mode (Off Reset button on the frequency converter, and the parametrization should also be performed with service switches off. After termination of the parameter settings, the frequency converter must be switched to the Auto mode by the Auto On button.

The recommended values of minimal frequency for fans are 20 Hz, and for rotary recuperators, 18 Hz. The motors could be insufficiently cooled at lower speeds. Set the maximum frequency of the rotary exchangers at 85Hz.

After terminating the parametrization and subsequent switching on the disconnector and the service switch, the failure LED must not come on and the motor must not start, even with minimal speed.

If such condition arises, the service switch must be switched off and the accuracy of the parameter settings must be carefully checked again, by the documentation enclosed to the frequency converter by the manufacturer.

If the frequency converter does not indicate any failure, the setting of minimal speed, the rotation direction of the fan and the function of the thermo-contact should be checked as follows:

- Interconnect terminals 12, 18 at the frequency converter (release of operation) at disconnected control voltage of 0-10 V from terminal 53. The minimal speed is displayed at the frequency converter display and the motor rotates in the direction of the arrow situated in the fan or rotary recuperator chamber.
- During motor operation at minimal speed, disconnect the motor thermo-contact from terminal 50. A failure must be displayed on the frequency converter display and the connected contact of the output relay must be disconnected.

5.3 Check of temperature detectors

The first check consists in comparison of the expected temperatures with the temperatures registered by the regulator and displayed in the ***Device parameters***Q***Temperatures*** menu. To compare the registered and the actual temperature, a calibrated thermometer should be used, serving subsequently to correct

the temperature in the regulator, provided the temperatures in the regulator correspond approximately to the registered temperatures. The correction of temperature can be performed only after entering the password.

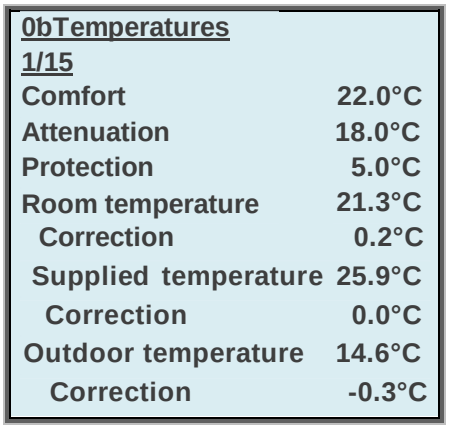


Figure 30 - Screen with temperatures and corrections

If the temperatures in the regulator differ markedly from the registered values or a value of 0.0°C is displayed without justification, the connection of the detectors must be checked. The actual registered value at the respective input is stated in the ***Device parameters***Q***Inputs /Outputs*** menu.

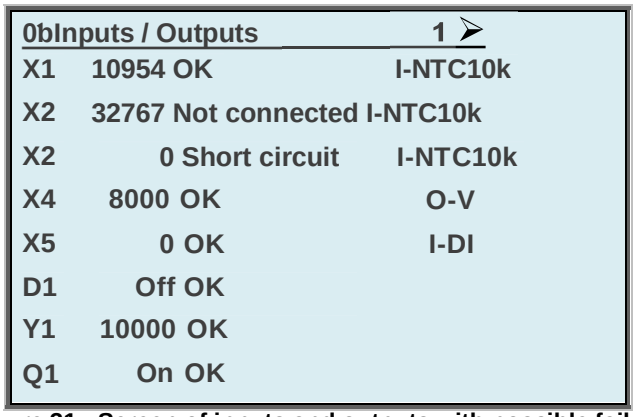


Figure 31 - Screen of inputs and outputs with possible failure variants

A failure of the temperature detectors may cause incorrect function of regulation of air-conditioning unit and is indicated in the display of the Climatix regulator by a fluttering bell in the upper right corner of the display. It can be caused by the following conditions:

- Mechanical damage of the temperature detector or of the measuring element, respectively
- Disruption of the interconnecting cable
- Short circuit of the interconnecting cable

5.4 Tests of air-conditioning unit components

The tests of individual components of the air-conditioning unit connected to MaR are carried out in the ***Device parameters***Q***Device test*** menu.

When performing the test, any mode currently in operation is terminated and the individual components of MaR of the air-conditioning unit are controlled independently, according to the parameters set in the Device test. When performing the test, some protection functions may be off.

The test is started by setting the ***Allow test*** item to ***Yes***. The test is terminated by setting the ***Allow test*** item to ***No***. If test is allowed, the standard control including the time program is blocked.

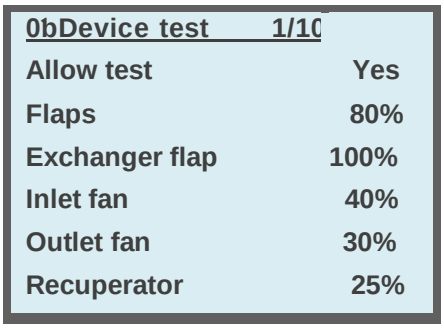


Figure 32 ï Screen of device test

5.4.1 Inlet, outlet and mixing flaps

The flaps are controlled with the help of servo-drives with standard power supply of 24 VAC, exceptionally 230 VAC, allowing switching of the direction of rotation.

If the unit does not contain the mixing flap, then the inlet and outlet flaps usually are fitted with two-position servo-drives whose positions are controlled by the relay contact at start of the fans. In such case, the flaps are not stated in the device test options, and the actual verification of the flap function is carried out at start of the air-conditioning unit:

- When the fans are off, the inlet and outlet flaps are closed.
- When the fans are on, the inlet and outlet flaps are open.

If the flaps have the inverse position than that required, the direction of rotation must be switched. If their position does not change, their power supply must be checked.

If the unit contains the mixing flap, then the inlet, outlet and mixing flap are usually fitted with servo-drives with continuous regulation controlling their positions. The mixing flap must be situated in opposite position to that of the inlet and outlet flap. The value entered in the ***Flaps*** item at testing corresponds to the position of the mixing flap:

- 0% - mixing flap closed, inlet and outlet flaps open.
- 30% - mixing flap 30%, inlet and outlet flaps 70%.

- 100% - mixing flap open, inlet and outlet flaps closed.

If the flaps have the inverse position than that required, the direction of rotation must be switched. If their position does not change, the power supply and the control voltage of the servo-drive must be checked. The requirement of 100% corresponds to voltage of 10 V, and 0% corresponds to voltage of 0 V or 2 V, according to the type of the servo-drive selected.
The final check should be carried out with the unit off and the testing mode off - the inlet and outlet flaps must be closed and the mixing flap must be open to 100%.

The inlet flap fitted with the servo-drive with emergency function is to be tested by simulating a power failure - the backward spring must close the flap completely, independently of the position of the other flaps.

5.4.2 Bypass flap of gas exchanger

The flap is fitted with a servo-drive with continuous regulation with standard power supply of 24 VAC, exceptionally 230 VAC, allowing switching of the direction of rotation. In the testing mode of the device, the percentage value must be set in the ***Exchanger flap*** item, corresponding to the opening angle of the flap.

If the flap has the inverse position than that required, the direction of rotation must be switched. If its position does not change, the power supply and the control voltage of the servo-drive must be checked. The requirement of 100% corresponds to voltage of 10 V, and 0% corresponds to voltage of 0 V or 2 V, according to the type of the servo-drive selected.

5.4.3 Flap of plate-type recuperator

The flap is fitted with a servo-drive with continuous regulation with standard power supply of 24 VAC, exceptionally 230 VAC, allowing switching of the direction of rotation. In the testing mode of the device, the percentage value must be set in the **Recuperator** item, corresponding to the opening angle of the bypass flap of the recuperator.

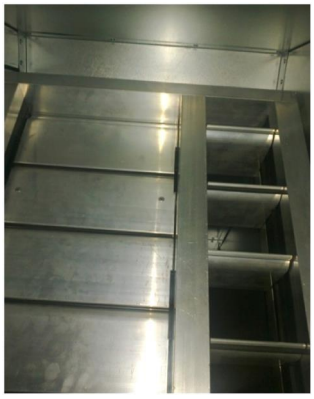


Figure 33 – Recuperation 0%

Figure 34 – Recuperation 100%

The flaps are situated on one shaft and controlled by one servo-drive. If the flaps have the inverse position than that represented in the picture, the direction of rotation must be switched. If their position does not change, the power supply and the control voltage of the servo-drive must be checked. The requirement of 100% corresponds to voltage of 10 V, and 0% corresponds to voltage of 0 V or 2 V, according to the type of the servo-drive selected.

5.4.4 Rotary recuperator

The rotary exchanger is switched on in the testing mode by setting the value in the ***Recuperator*** item to the required (non-zero) output value in percentage, corresponding to the speed of the rotary recuperator.

The requirement of 100% corresponds to control voltage of 10 V, brought to the frequency converter of the recuperator, and at the same time to the maximum speed or frequency, usually 85 Hz.

The requirement of 1% corresponds to control voltage of 0,1 V, brought to the frequency converter of the recuperator, and at the same time to the maximum speed or frequency, usually 18Hz.

The requirement of 0% corresponds to control voltage of 0 V, brought to the frequency converter of the recuperator that will switch off at that value.

When verifying the requirement, it is also necessary to check the direction of rotation of the rotary recuperator.

The motor of the rotary recuperator does not have any thermo-contact, so that the terminals 29 and 50 must be connected on the control terminal box of the frequency converter of the rotary recuperator.

5.4.5 Fans

The inlet fan, or the outlet fan, respectively, is switched in the testing mode by setting the value in ***Inlet fan*** or ***Outlet fan***, respectively, to the required (non-zero) speed value in percentage, which must correspond to the speed of the inlet fan or outlet fan, respectively.

The requirement of 100% corresponds to control voltage of 10 V, brought to the frequency converter of the inlet or outlet fan, respectively, and at the same time to the maximum speed or frequency, respectively.

The requirement of 1% corresponds to control voltage of 0,1 V, brought to the frequency converter of the inlet or outlet fan, respectively, and at the same time to the minimum speed or frequency, respectively, usually 20 Hz.

The requirement of 0% corresponds to control voltage of 0 V, brought to the frequency converter of the inlet or outlet fan, respectively, that will switch off at that value. If the frequency converters of the inlet and outlet fan are switched on by one relay

output of the regulator according to the electrical project documentation, the fans will be switched off only if the performance requirement will be zero for both fans.

When verifying the requirement, it is also necessary to check the direction of rotation of the both fans. The fan operation is indicated by white LED in the MaR system switchboard.

5.4.6 Gas heating

The gas heater is switched on in the testing mode by setting the value in ***Burner*** item to the required (non-zero) output value in percentage.

The requirement of 100% corresponds to control voltage of 10 V and at the same time to the maximum output of the Monzun gas heater, depending on its setting at its ignition.

The requirement of 1% corresponds to control voltage of 0,1 V and at the same time to the minimum output of the Monzun gas heater, depending on its setting at its ignition.

The requirement of 0% corresponds to control voltage of 0 V; the gas heater is switched off at that value.

If the burner is not ignited upon entering the requirement, the emergency thermostat must be checked. The emergency thermostat of the Monzun gas heater is situated at gas heating wiring under the removable cover, see Figure 25. The RTH plastic box with the thermostat of the Pecín gas heater is usually placed on the wall of the gas heater.

When testing the gas heater, at least the inlet fan must be on and the inlet flap must be open, to avoid overheating of the heater!

5.4.7 Water heating

Sufficiently warm water must be provided for testing of the water heater. The water heater is switched on in the testing mode by setting the value in ***Water heating*** item to the required (non-zero) output value in percentage.

The requirement of 100% corresponds to control voltage of 10 V and at the same time to the maximal output of the water heater; the mixing flap is open to 100% and the pump switched on.

The requirement of 1% corresponds to control voltage of 0,1 V and at the same time to the minimal output of the water heater; the mixing flap is open to 1% and the pump switched on.

The requirement of 0% corresponds to control voltage of 0 V; the water heater pump is switched off at that value.

If the water heating is not switched on upon entering the requirement, the anti-freeze thermostat must be checked; the anti-freeze thermostat is situated in the water exchanger chamber, see Figure 24.

The heater pump is switched on during testing. Therefore the water circuit must be always sufficiently filled or the pump disconnected from supply, otherwise the pump bearings could be permanently damaged.

Another point consists in check of function of anti-freeze control. The simulation must be carried out only after the device testing has been terminated (***Allow test*** = ***No***) and the contact of the emergency thermostat has been disconnected. The procedure is as follows:

- Go to the initial screen of the regulator, select the ***Comfort*** or ***Attenuation*** mode,
- disconnect the cable of anti-freeze thermostat from XS:25 or XS:26 terminal.

After disconnecting the contact, the air-conditioning unit must:

- switch off the fans,
- close the inlet and outlet flap,
- switch on the heating water pump,
- open the water heating mixing flap to 100%,
- announce failure on the regulator display.

After reconnecting the cable of anti-freeze thermostat, the failure will remain until it is confirmed. The confirmation is carried out in the regulator alarms after entering the password. When the failure has been confirmed and subsequently terminated, the unit must start by itself.

5.4.8 Electrical heating

The electric heater is switched on in the testing mode by setting the value in ***Electrical heating*** item to the required (non-zero) output value in percentage.

The requirement of 100% corresponds to control voltage of 10 V and at the same time to the maximal output of the electric heater.

The requirement of 1% corresponds to control voltage of 0,1 V and at the same time to the minimal output of the electric heater.

The requirement of 0% corresponds to control voltage of 0 V; the electric heater is switched off at that value.

If the burner does not ignite upon entering the requirement, the emergency thermostat must be checked; the emergency thermostat is accessible upon removing the cover of the electric heater, see Figure 28.

When testing the electric heater, at least the inlet fan must be on and the inlet flap must be open, to avoid overheating of the heater!

6. Final setting of regulation parameters

After the check of the individual components, the testing mode of the device must be terminated by setting the ***Allow test*** item to ***No.*** On the initial screen of the regulator, set ***Control*** to ***Manual*** and ***Mode*** to ***Comfort***. The air-conditioning unit will start and it will be regulated to the factory parameters. The setting of those parameters may not be ideal for the specific installation, as the local conditions and requirements will necessarily affect the behaviour of the regulation systems. Such deviations from the original project must be taken into account by additional parameter modification. The modification concerns particularly the configuration parameters, regulation constants, correction values, operation parameters, temperature modes, optional modes or functions and time programs.

The list of alarm messages can be found in Annex C.

For more information on setting of operation modes and other components of the Mandík air-condition unit use: MANDÍK air-conditioning unit, detailed instructions for operation and commissioning.

7. Alarms

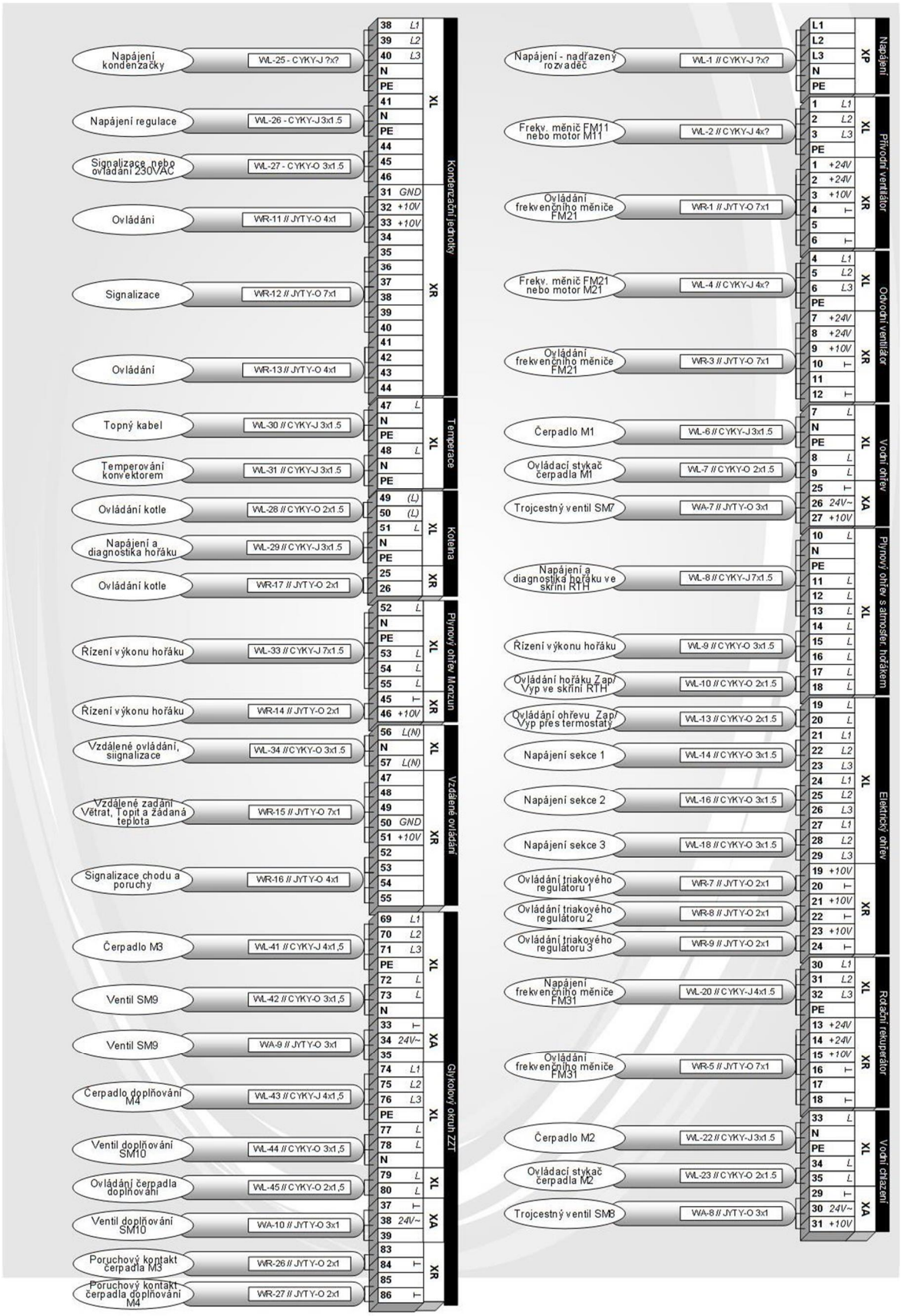
The alarm message screen is accessibly through ***Alarm*** key, marked with a bell or red LED. A new alarm is indicated by a fluttering bell on the display or by the blinking LED in the button. Confirmation is carried out in ***Alarm messages***Q***Alarm list*** by setting the ***Confirm*** item to ***Execute***. After confirming, which is possible only after entering the password, the LED will stop blinking provided the alarm has ceased to exist. The number of active alarms is on the same line.

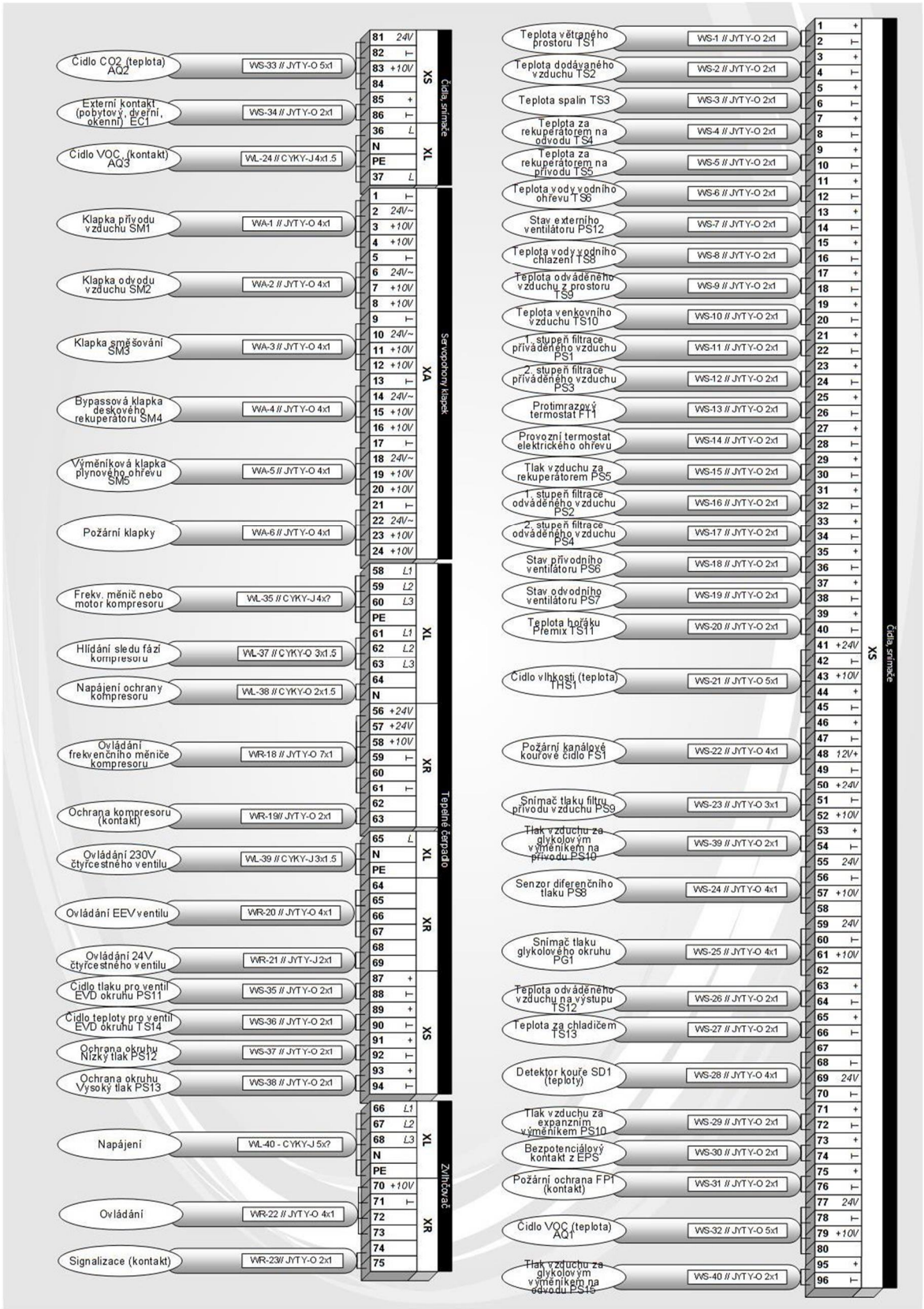
After confirming, the alarms are transferred from ***Alarm messages***Q***Alarm list*** to ***Alarm messages***Q***Alarm history***. The ***Alarm list*** and the ***Alarm history*** may contain 50 items at the maximum and they work in circle. That means that the newest alarm rewrites the oldest one. Each alarm occupies two to three lines. The first line contains the alarm name and the last change stating whether the alarm has emerged or ceased to exist. The second line contains the information on the alarm type, and the third line contains the date and time when the alarm emerged or ceased to exist.

The list of all alarm messages is described in the following table. For all components in which the contact is monitored, connected contact is expected in case of correct function, except for gas heating! The alarm classes have the following meaning:

- ***Class A+ -*** The highest alarm shuts down the air-conditioning unit that will be restarted only after eliminating and confirming the alarm.
- ***Class A -*** The high alarm shuts down the air-conditioning unit that will be restarted only after eliminating the alarm cause without confirming the alarm.
- ***Class B -*** The low alarm will not shut down the air-conditioning unit, but the unit will run in auxiliary mode.
- ***Class C*** - The alarm has only a warning character; the air-conditioning unit keeps running.

Annex A. Unified system of connection of MaR components in MANDÍK KJM control boxes




Čidlo CO2 (teplota) AQ2
WS-33 // JYTY-O 5x1
Externí kontakt (pobytový, dveřní, okenní) EC1
WS-34 // JYTY-O 2x1
Čidlo VOC (kontakt) AQ3
WL-24 // CYKY-J 4x1.5
Čidla, snímače
XS
XL
Klapka přívodu vzduchu SM1
WA-1 // JYTY-O 4x1
Klapka odvodu vzduchu SM2
WA-2 // JYTY-O 4x1
Klapka směšování SM3
WA-3 // JYTY-O 4x1
Bypassová klapka deskového rekuperátoru SM4
WA-4 // JYTY-O 4x1
Výměníková klapka plynového ohřevu SM5
WA-5 // JYTY-O 4x1
Požární klapky
WA-6 // JYTY-O 4x1
Servopohony klapek
XA
Frekv. měnič nebo motor kompresoru
WL-35 // CYKY-J 4x?
Hlídání sledu fází kompresoru
WL-37 // CYKY-O 3x1.5
Napájení ochrany kompresoru
WL-38 // CYKY-O 2x1.5
Ovládání frekvenčního měniče kompresoru
WR-18 // JYTY-O 7x1
Ochrana kompresoru (kontakt)
WR-19// JYTY-O 2x1
Tepelné čerpadlo
XR
Ovládání 230V čtyřcestného ventilu
WL-39 // CYKY-J 3x1.5
Ovládání EEV ventilu
WR-20 // JYTY-O 4x1
Ovládání 24V čtyřcestného ventilu
WR-21 // JYTY-J 2x1
Čidlo tlaku pro ventil EVD okruhu PS11
WS-35 // JYTY-O 2x1
Čidlo teploty pro ventil EVD okruhu TS14
WS-36 // JYTY-O 2x1
Ochrana okruhu Nízký tlak PS12
WS-37 // JYTY-O 2x1
Ochrana okruhu Vysoký tlak PS13
WS-38 // JYTY-O 2x1
Napájení
WL-40 - CYKY-J 5x?
Zvlhčovač
Ovládání
WR-22 // JYTY-O 4x1
Signalizace (kontakt)
WR-23// JYTY-J 2x1
Teplota větraného prostoru TS1
WS-1 // JYTY-O 2x1
Teplota dodávaného vzduchu TS2
WS-2 // JYTY-O 2x1
Teplota spalin TS3
WS-3 // JYTY-O 2x1
Teplota za rekuperátorem na odvodu TS4
WS-4 // JYTY-O 2x1
Teplota za rekuperátorem na přívodu TS5
WS-5 // JYTY-O 2x1
Teplota vody vodního ohřevu TS6
WS-6 // JYTY-O 2x1
Stav externího ventilátoru PS12
WS-7 // JYTY-O 2x1
Teplota vody vodního chlazení TS8
WS-8 // JYTY-O 2x1
Teplota odváděného vzduchu z prostoru TS9
WS-9 // JYTY-O 2x1
Teplota venkovního vzduchu TS10
WS-10 // JYTY-O 2x1
1. stupeň filtrace přiváděného vzduchu PS1
WS-11 // JYTY-O 2x1
2. stupeň filtrace přiváděného vzduchu PS3
WS-12 // JYTY-O 2x1
Protimrazový termostat PT1
WS-13 // JYTY-O 2x1
Provozní termostat elektrického ohřevu
WS-14 // JYTY-O 2x1
Tlak vzduchu za rekuperátorem PS5
WS-15 // JYTY-O 2x1
1. stupeň filtrace odváděného vzduchu PS2
WS-16 // JYTY-O 2x1
2. stupeň filtrace odváděného vzduchu PS4
WS-17 // JYTY-O 2x1
Stav přívodního ventilátoru PS6
WS-18 // JYTY-O 2x1
Stav odvodního ventilátoru PS7
WS-19 // JYTY-O 2x1
Teplota hořáku Premix TS11
WS-20 // JYTY-O 2x1
Čidla, snímače
XS
Čidlo vlhkosti (teplota) THS1
WS-21 // JYTY-O 5x1
Požární kanálové kouřové čidlo PS1
WS-22 // JYTY-O 4x1
Snímač tlaku filtru přívodu vzduchu PS9
WS-23 // JYTY-O 3x1
Tlak vzduchu za glykolovým výměníkem na přívodu PS10
WS-39 // JYTY-O 2x1
Senzor diferenčního tlaku PS8
WS-24 // JYTY-O 4x1
Snímač tlaku glykolového okruhu PG1
WS-25 // JYTY-O 4x1
Teplota odváděného vzduchu na výstupu TS12
WS-26 // JYTY-O 2x1
Teplota za chladičem TS13
WS-27 // JYTY-O 2x1
Detektor kouře SD1 (teploty)
WS-28 // JYTY-O 4x1
Tlak vzduchu za expanzním výměníkem PS10
WS-29 // JYTY-O 2x1
Bezpotenciálový kontakt z EPS
WS-30 // JYTY-O 2x1
Požární ochrana FP1 (kontakt)
WS-31 // JYTY-O 2x1
Čidlo VOC (teplota) AQ1
WS-32 // JYTY-O 5x1
Tlak vzduchu za glykolovým výměníkem na odvodu PS15
WS-40 // JYTY-O 2x1

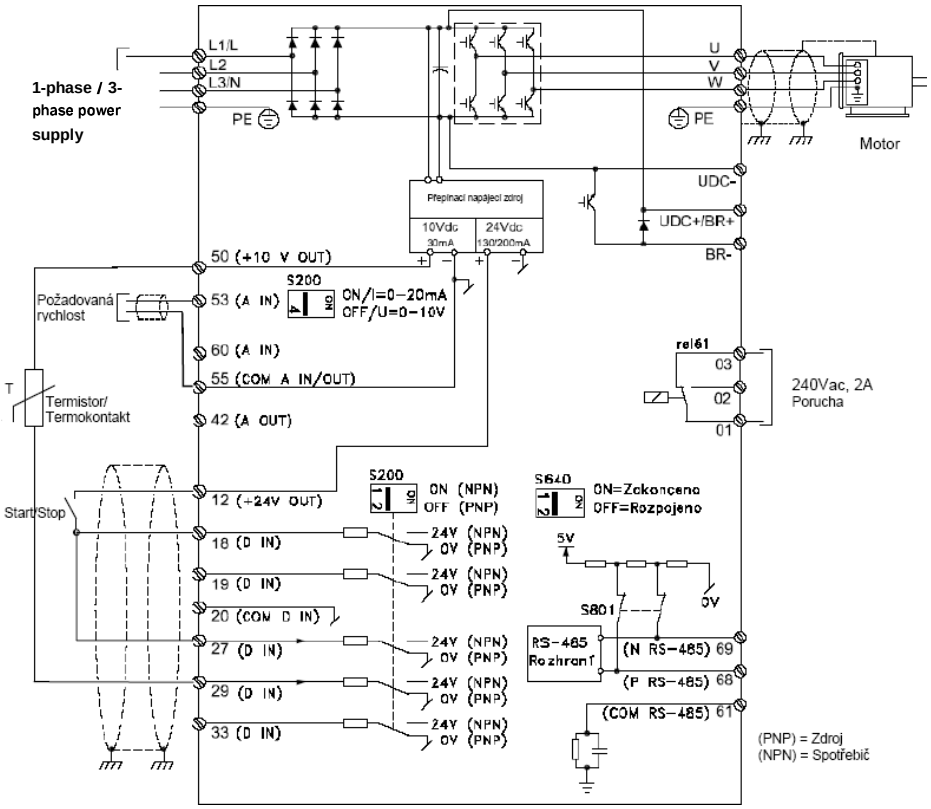
Napájení kondenzační ky	Supply of condensation	Napájení ídí nadřazený rozvaděč	Supply ídí superordinate switchboard
Napájení regulace	Supply of regulation	Frekv. měnič FM11 nebo motor M11	Frequency converter FM11 or motor
Signalizace nebo ovládání 230VAC	Indication or control 230 VAC	Ovládání frekvenčního měniče FM21	Control of frequency converter FM21
Ovládání	Control		
Signalizace	Indication	Frekv. měnič FM21 nebo motor M21	Frequency converter FM21 or motor M21
Ovládání	Control	Ovládání frekvenčního měniče FM21	Control of frequency converter FM21
Topný kabel	Heating cable	Čerpadlo M1	Pump M1
Temperování konvektorem	Moderate heating by convector	Ovládací stykač čerpadla M1	Control contactor of pump M1
Ovládání kotle	Boiler control	Trojcestný ventil SM7	Three-way valve SM7
Napájení a diagnostika hořáku	Supply and diagnostic of burner		
Ovládání kotle	Burner control	Napájení a diagnostika hořáku ve skříni RTH	Supply and diagnostics of burner in box RTH
řízení výkonu hořáku	Burner output control	řízení výkonu hořáku	Burner output control
		Ovládání hořáku Zap/Vyp ve skříni RTH	Control of burner ON/OFF in box RTH
řízení výkonu hořáku	Burner output control	Ovládání ohřevu Zap/Vyp přes termostaty	Control of heating On/OFF through thermostats
Vzdálené ovládání, signalizace	Remote control, indication	Napájení sekce 1	Supply of section 1
Vzdál. zadání Větrat, Topit a Žádaná teplota	Remote entry of Ventilation, Heating and Required temperature	Napájení sekce 2	Supply of section 2
		Napájení sekce 3	Supply of section 3
Signalizace chodu a poruchy	Indication of operation and error	Ovládání triakového regulátoru 1	Control of triac regulator 1
		Ovládání triakového regulátoru 2	Control of triac regulator 2
Čerpadlo M3	Pump M3	Ovládání triakového regulátoru 3	Control of triac regulator 3
Ventil SM9	Valve SM9	Napájení frekvenčního měniče FM31	Supply of frequency converter FM31
Ventil SM9	Valve SM9	Ovládání frekvenčního měniče FM31	Control of frequency converter FM31
Čerpadlo doplňování M4	Refilling pump M4		
Ventil doplňování SM10	Refilling valve SM10	Čerpadlo M2	Pump M2
Ovládání čerpadla doplňování	Control of refilling pump	Ovládací stykač čerpadla M2	Control contactor of pump M2
Ventil doplňování SM10	Refilling valve SM10	Trojcestný ventil SMB	Three-way valve SMB
Poruchový kontakt čerpadla M3	Error contact of pump M3		
Poruchový kontakt čerpadla doplňování M4	Error contact of refilling pump M4		

Čidlo CO2 (teplota) AQ2	CO2 detector (temperature) AQ2	Teplota vytápěného prostoru TS1	Temperature of ventilated room TS1
		Teplota dodávaného vzduchu TS2	Temperature of supplied air TS2
Externí kontakt (pobytový, dveřní, okenní) EC1	External contact (presence, door, window) EC1	Teplota spalin TS3	Flue gas temperature TS3
		Teplota za rekuperátorem na odvodu TS4	Temperature after recuperator at outlet TS4
		Teplota vody vodního ohřevu TS6	Water temperature of water heating TS6
Klapka přívodu vzduchu SM1	Air inlet flap SM1	Stav externího ventilátoru PS12	Status of external fan PS12
		Teplota vody vodního chlazení TS8	Water temperature of water cooling TS8
Klapka odvodu vzduchu SM2	Air outlet flap SM2	Teplota odváděného vzduchu z prostoru TS9	Temperature of outlet air from room TS9
		Teplota venkovního vzduchu TS10	Outdoor air temperature TS10
Klapka směšování SM3	Mixing flap SM3	1. stupeň filtrace přiváděného vzduchu PS1	1st degree of inlet air filtration PS1
		2. stupeň filtrace přiváděného vzduchu PS3	2nd degree of inlet air filtration PS3
Bypassová klapka deskového rekuperátoru SM4	Bypass flap of plate-type recuperator SM4	Protimrazový thermostat FT1	Anti-freeze thermostat FT1
		Provozní thermostat elektrického ohřevu	Operation thermostat of electric heating
Výměníková klapka plynového ohřevu SMS	Exchanger flap of gas heating SMS	Tlak vzduchu za rekuperátorem PS5	Air pressure after recuperator PS5
		1. stupeň filtrace odváděného vzduchu PS2	1st degree of filtration of outlet air PS2
Požární klapky	Fire flaps	2. stupeň filtrace odváděného vzduchu PS4	2nd degree of filtration of outlet air PS4
		Stav přívodního ventilátoru PS6	Status of inlet fan PS6
Frekv. měniče nebo motor kompresoru	Freq. converter or motor of compressor	Stav odvodního ventilátoru PS7	Status of outlet fan PS7
		Teplota hořáku Premix TS11	Temperature of burner Premix TS11
Hlídání sledu fází kompresoru	Monitoring of compressor phase sequence		
Napájení ochrany kompresoru	Supply of compressor protection	Čidlo vlhkosti (teplota) THS1	Humidity (temperature) detector THS1
Ovládání frekvenčního měniče kompresoru	Control of frequency converter of compressor	Požární kanálové kouřové čidlo FS1	Channel smoke fire detector FS1
Ochrana kompresoru (kontakt)	Compressor protection (contact)	Snímač tlaku filtru přívodu vzduchu PS9	Pressure detector of air inlet filter PS9
Ovládání 230V	Control of 230 V four-	Tlak vzduchu za	Air pressure after glycol

ţ tyŚestného ventilu	way valve	glykolovým výmĎníkem na pŚívodu PS10	exchanger at inlet PS10
Ovládání EEV ventilu	Control of EEV valve	Senzor diferenţního tlaku PS8	Differential pressure sensor PS8
Ovládání 24V ţ tyŚestného ventilu	Control of 24V four-way valve	Snímaţ tlaku glykolového okruhu PG1	Pressure detector of glycol circuit PG1
Ţidlo tlaku pro ventil EVD okruhu PS11	Pressure detector for valve of EVD circuit PS11	Teplota odvádĎného vzduchu na výstupu TS12	Temperature of outlet air at output TS11
Ţidlo teploty pro ventil EVD okruhu TS14	Temperature detector for valve of EVD circuit TS14	Teplota za chladiţem TS13	Temperature after cooler TS13
Ochrana okruhu Nízký tlak PS12	Circuit protection Low pressure PS12		
Ochrana okruhu Vysoký tlak PS13	Circuit protection High pressure PS13	Detektor kouŚe SD1 (teploty)	Smoke detector SD1 (temperature)
		Tlak vzduchu za expanzním výmĎníkem PS10	Air pressure after expansion exchanger PS10
Napájení	Supply	Bezpotenciálový kontakt z EPS	Potential-free contact from EPS
		PoŞární ochrana FPI (kontakt)	Fire protection FPI (contact)
Ovládání	Control	Ţidlo VOC (teplota) AQ1	Detector VOC (temperature) AQ1
Signalizace (kontakt)	Indication (contact)	Tlak vzduchu za glykolovým výmĎníkem na odvodu PS15	Air pressure after glycol exchanger at outlet PS15

Annex B. Recommended parameter setting for VLT® Micro Drive FC-51 of MANDÍK air-conditioning unit

Wiring of power supply, motor and control terminals



Translation of the mentioned designations:
poğadovaná rychlost = **required speed**, termistor / termokontakt = **thermistor / thermo-contact**, porucha = **failure**, zakonļ eno = **terminated**, rozpojeno = **disconnected**, zdroj = **source**, spotŚebiļ = **appliance**

Wiring of power supply

FIRST: CHECK THE VOLTAGE VERSION OF THE EXCHANGER (1x200-240V or 3x380-460V)
ï to see whether there is 3-ph or 1-ph input to the exchanger

1. Connect the supplycable:
   - for 3-ph input, connect the cable to the terminals marked with L1,L2,L3
   - for 1-ph input, connect the cable to the terminals marked with L1 and N
2. Connect the PE wire to PE terminal (earthing symbol)
3. Connect the motor cable to U, V, W terminals
4. Connect the PE wire and screening

Parameter setting (control from control terminal box, control voltage 0-10 V)

Parameter number	Name	Factory settings	Inlet fan	Outlet fan	Units
1-20	Motor output		1.50	1.50	kW
1-22	Motor voltage		400	400	V
1-23	Motor frequency		50	50	Hz
1-24	Motor current		3.19	3.19	A
1-25	Nominal motor speed		2865	2865	rpm
1-62	Slip compensation	100	0	0	%
1-73	Rolling start	Disabled [0]	1	1	
1-90	Thermal protection of motor	No protection [0]	2	2	
1-93	Thermistor source	None [0]	6	6	
3-02	Minimal required value	0	20	20	
3-03	Maximal required value	50	56		
3-15	Source of required value 1	Input 53 [1]	1	1	
3-16	Source of required value 2	Input 60 [2]	0	0	
3-17	Source of required value 3	Local bus [3]	0	0	
3-41	Ramp 1, Start-up time	3	30	30	s
3-42	Ramp 1, Tun-out time	3	60	60	s
4-12	Minimal motor speed	0	20	20	Hz
4-14	Maximal motor speed	65	57	57	Hz
4-16	Moment limit for motor mode	150	180	180	%
5-12	Terminal 27, Digital input	Reset [1]	3	3	
5-13	Terminal 29, Digital input	Jog [14]	0	0	
5-40	Relay function	No operation [0]	5	5	
6-14	Terminal 53, low required value	0	20	20	Hz
6-15	Terminal 53, high required value	50	56		Hz
8-01	Control method	0	1	1	

For more information on the setting procedure see the enclosed manual.

Setting with the help of the control panel

Obr.1.2: Ovládací panel bez potenciometru

Figure 1.2: Control panel without potentiometer

Obr.1.3.: Přepínání menu

1. Tlačítkem Menu přepnout na položku Main Menu (indikace pomocí černé šipky na displeji).
2. Nyní pomocí tlačítek OK, Back a [▲] [▼] se můžete pohybovat v parametrech menu.
3. Změnu provedete pomocí tlačítka OK -> [▲] [▼]->OK

Fig. 1.3: Menu switching

1. With Menu button switch to Main Menu item (indication by black arrow in the display).

2. Now you can browse in the menu parameters with the help of OK, Back and (≠), (Ƹ) buttons.
3. Perform any change with the help of OK -> (≠), (Ƹ) -> OK button.

In case of any problems, please contact the supplier or Mandík service:

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Annex C. Alarm list

Alarm name	Class	Alarm description
Water heating pump (WtrHtgPmpErr)	B	Error of water heating pump from pump circuit breaker contact.
Supplied temperature (LimitTempAir)	A	Low or high temperature of supplied air based on ***Low supplied temperature*** or ***High supplied temperature*** parameters.
Supplied temperature.AI (TempSupply.AI)	A	Damaged, not connected or wrongly configured temperature detector.
Gas heating supplied temperature (LowTempHeatErr)	A	Low ventilation temperature at gas heating error according to value of ***Burner error*** in ***Fan*** component.
Water heating supplied temperature (WtrHtgSplyFrstA)	B	The supplied air temperature at water heating is lower than 6°C.
Electric heating (ElHeatStageErr)	B	Information on error of electric heating based on monitoring of thermostat contact.
2 Electric heating (ElHeat2StageErr)	B	Information on error of second electric heating based on monitoring of thermostat contact.
3 Electric heating (ElHeat3StageErr)	B	Information on error of third electric heating based on monitoring of thermostat contact.
Outlet filter (FiltrOutStageBad)	C	Clogged outlet filter from manostat contact.
2 Outlet filter (FiltrOut2StageBad)	C	Clogged second outlet filter from manostat contact.
Inlet filter (FiltrInpStageBad)	C	Clogged inlet filter from manostat contact.
2 Inlet filter (FiltrInp2StageBad)	C	Clogged second inlet filter from manostat contact.
Fat filter (FiltrFatStageBad)	C	Clogged fat filter from manostat contact.
2 Fat filter (FiltrFat2StageBad)	C	Clogged second fat filter from manostat contact.
Burner operation (BurnerFbk)	B	Information on error of gas burner based on contact of relay informing about its operation. It may be caused by emergency thermostat of gas heating.
2 Burner operation (Burner2Fbk)	B	Information on error of second gas burner based on contact of relay informing about its operation. It may be caused by emergency thermostat of gas heating.
Burner error (BurnerErr)	B	Information on error of gas burner based on contact of relay informing of its error indicated also directly on the burner or on the burner chamber.

Alarm name	Class	Alarm description
2 Burner error (Burner2Err)	B	Information on error of gas burner based on contact of relay informing of its error indicated also directly on the burner or on the burner chamber.
Cooling water temperature.AI (TempWaterCool.AI)	A	Damaged, not connected or wrongly configured temperature detector.
Cooling Condensing unit (CoolErr)	B	Information on error of Cooling / Condensing unit based on monitoring of contact informing on error.
2 Cooling Condensing unit (CoolErr2)	B	Information on error of second Cooling / Condensing unit based on monitoring of contact informing on error.
3 Cooling Condensing Unit (CoolErr3)	B	Information on error of third Cooling / Condensing unit based on monitoring of contact informing on error.
Gas heating exchanger flap.AI (FlapExchSelAI.AI)	B	Damaged, not connected or wrongly configured monitoring of position of bypass flap of gas exchanger.
Condensing unit (CoolerErr)	B	Information on error of Cooling / Condensing unit based on monitoring of contact informing on operation of its cooling or heating.
Air quality (AirQuality)	B	Bad air quality indicated by contact or analogue detector according to limit values of ***On*** and ***Off*** in ***Air quality*** component.
Air quality.AI (AirQualAI)	B	Damaged, not connected or wrongly configured air quality detector.
Low temperature of water heating start (LowTempWtr)	B	Low temperature of outlet water of water heating at low temperature of outer air at unit start according to limit values of ***Starting water temperature*** and ***Low outdoor temperature*** in ***Water heating*** component.
Outlet temperature.AI (TempExhaust.AI)	A	Damaged, not connected or wrongly configured temperature detector.
2 Outlet temperature.AI (TempExhaust2.AI)	A	Damaged, not connected or wrongly configured temperature detector.
Water heating outlet water (WtrHtgWtrFrstAlm)	B	The outlet water temperature of water heating is lower than 6°C.
Defrosting of condensing unit (Defros)	B	Information on defrosting of condensing unit based on contact monitoring.
2 Defrosting of condensing unit (Defros1)	B	Information on defrosting of second condensing unit based on contact monitoring.
3 Defrosting of condensing unit	B	Information on defrosting of third condensing unit

(Defros2)		based on contact monitoring.
Fire (Fire)	A	Indication of fire hazard by contact.
Room temperature.AI (TempRoom.AI)	A	Damaged, not connected or wrongly configured temperature detector.

Alarm name	Class	Alarm description
2 Room temperature.AI (TempRoom2.AI)	A	Damaged, not connected or wrongly configured temperature detector.
3 Room temperature.AI (TempRoom3.AI)	A	Damaged, not connected or wrongly configured temperature detector.
4 Room temperature.AI (TempRoom4.AI)	A	Damaged, not connected or wrongly configured temperature detector.
Recuperator frequency converter (RotRecStageErr)	B	Error of frequency converter of recuperator motor from frequency converter contact.
Anti-freeze protection of recuperator (RekupFrostAlm)	B	Freezing of recuperator indicated from contact of manostat or temperature detector after the recuperator by value of ***Freezing*** in ***Recuperator*** component.
Flue temperature.AI (TempFlue.AI)	A	Damaged, not connected or wrongly configured temperature detector.
Service (Service)	C	Information on next required service inspection according to the value in ***Next service*** component.
Outlet pressure AI (FanOutRegAI)	B	Damaged, not connected or wrongly configured air pressure detector of outlet fan.
Inlet pressure AI (FanRegAI)	B	Damaged, not connected or wrongly configured air pressure detector of inlet fan.
Heating water temperature.AI (TempWaterHeat)	A	Damaged, not connected or wrongly configured temperature detector.
Outdoor temperature.AI (TempOutdoor)	A	Damaged, not connected or wrongly configured temperature detector.
Outlet fan (FanOutStageFbk)	A+	Error of frequency converter of motor of outlet fan from frequency converter contact.
2 Outlet fan (FanOutStageFbk)	A+	Error of frequency converter of motor of second outlet fan from frequency converter contact.
Inlet fan (FanOut2StageFbk)	A+	Error of frequency converter of motor of inlet fan from frequency converter contact.
Air humidity (HumidityAI)	B	Bad air humidity indicated by contact or analogue detector according to limit values of ***On*** and ***Off*** in ***Humidity*** component.
Air humidity.AI ((HumidityAI))	A	Damaged, not connected or wrongly configured air humidity detector.
Anti-freeze protection of water heating (WtrHtgFrstDtctr)	A	Low air temperature from capillary tube of anti-freeze protection of water exchanger.

Gas heating flue gas temperature (SafeBurnerTemp)	B	High temperature of gas heating flue gases according to value of ***Max flue*** in ***Gas heating*** component, at which the burner is switched off.

Notes: