Pressure differential kit
in smoke and heat control systems

iSWAY-FC®

The functionality and reliability in hydraulic,
electrical and electronic aspects in accordance with:
Technical Approval ITB AT-15-9020/2012,
confirmed by Certificate of Conformity ITB-2189/W
and the national Declaration of Conformity Smay LLC No. 282/2013
iSWAY-FC® - compact pressurization unit with integrated control system

Application

The iSWAY-FC® series compact pressurization units (pressure differential kits in accordance with EN 12101-6) are comprehensive technical solutions designated to overpressure protection of both vertical and horizontal escape routes in the various buildings in case of fire. All iSWAY-FC® series units are equipped with predictive algorithm regulators which provide automatic adjustment of the operating parameters to the dynamic changes of the ambient e.g. wind speed and direction, air temperature and internal parameters e.g. different evacuation scenarios. Capacity of the air supply axial flow fan is continuously adjusted by means of the Danfoss frequency inverter with the FIRE MODE function which shall be applied in smoke and heat control systems.

Correspondent iSWAY-FC® units can be equipped with dedicated automatics enabling to protect of certain spaces depending on the local requirements in the building.

Due to the applied control system and wide range of accessories iSWAY-FC® series units can be used to protect number of spaces with different cubature e.g. staircases, lift-shafts etc. Moreover due to the compact design and structure iSWAY-FC® series compact pressurization units can be assembled almost anywhere inside the building e.g. technical floors, roof level or ground level.

Technically iSWAY-FC® series units are comprehensive technical solutions for overpressure protection against smokiness of escape routes in buildings in case of fire. Thanks to a compact design and a wide range of versions this units can be installed almost anywhere in the building, whereas varying performance of offered fans provides the required level of pressure gradient and normative velocity of air outflow from the protected spaces.

Units from the iSWAY-FC® series are designed to produce the set value of overpressure within the space of staircase, shaft of rescue elevator or in a system of separate elevator shafts (each with its own air supply point in reference to the fire floor). It is also possible the use iSWAY-FC® units to control the pressure in the air supply duct.

Figure 1. Exemplary illustration of connection of iSWAY-FC® unit to the protected space

iSWAY-FC® units may be used to protect a single space, where a single control system built into the unit’s housing is sufficient. Producing and controlling the overpressure at the set value prevents the infiltration of smoke and hot fire gases into protected space while keeping escape routes smoke free. Supplying the air into the space protected by overpressure can be realised using a single air supply point, as well as through multiple injection.

Thanks to the use of MAC-FC regulator, there is no need for mechanical over-pressure relief dampers (pressure control dampers) as elements for pressure control. This is particularly important for the installation, in which to provide normative pressure criteria, and flow to the protected space large air supply rates are required. Therefore, large-size mechanical damper are required, which may be difficult or even impossible to achieve.
Application

Figure 2. Multiple injection air supply to the staircase

Note:
1. TSS - Control - Signal Board - to be located at the fire brigades access level, near the building entrance.
2. Maximum length of the pulse tubes equal to 12 m. Measurement carried out by the pressure differential sensor located in the unit.

In case of losing communication between pressure sensor, regulator goes automatically into emergency control mode.
Application

Figure 3. Multiple injection to the staircase – remote pressure sensor

Note:
1. TSS - Control - Signal Board - to be located at the fire brigades access level, near the building entrance.
2. Maximum length of the pulse tubes equal to 12 m.
3. P-MACF - remote pressure sensor connected to iSWAY-FC® unit by Local FireBUS loop.

In case when iSWAY-FC® unit is not located directly at the top of protected space what could create the need to carry out a long impulse tubes of pressure measurement, a replacement solution in the form of P-MACF remote sensor is used, located in the protected space and connected with iSWAY-FC® by bus loop of communication protocol FireBUS (more on the protocol later in this data sheet).

In case of losing communication between pressure sensor, regulator goes automatically into emergency control mode.
Figure 4. Concentrated air supply to the staircase

Application

Note:
1. TSS - Control - Signal Board - to be placed at the access level of firefighting and rescue services, near the entrance.
2. The maximum length of the pulse cables equal to 12m.
3. The applicability of the concentrated air supply should be analyzed for each case, considering local technical conditions in the building and selected class of pressure differential system (PDS).
iSWAY-FC® units with a single air supply point to the protected space do not require vertical air supply ducts to pressurize the staircase. Spared area can be used to build in air ductwork used to pressurize fire-fighting lobbies. Optionally it is possible to use obtained floor area for rental purposes.

In case of losing communication between pressure transducer, regulator goes automatically into emergency control mode.
Application

iSWAY-FC® - with pressure sensor P-MACF and regulator MAC-FC – fire-fighting lobbies pressurization system capable to supply constant compensative air volume to the smoke extracted corridors. Additional unit supplying air to the staircases or lift shafts.

Figure 5. Simultaneous pressurization of the staircase and fire-fighting lobbies

Figure 6. Simultaneous pressurization of the staircase and fire-fighting lobby with electronically controlled air transfer to the corridors
iSWAY-FC® - compact pressurization unit with integrated control system

Note:
1. For complex PDS the MSPU (Operating Conditions Monitoring Device), and TS (Control Board) should be used, located in the monitoring room (near the building entrance).
2. Total length of the pulse tube up to 12 m.
3. Possibility of application of the concentrated air supply should be analyzed for each case, considering local technical conditions in the building and design PDS performance class.
4. Up to 30 P-MACF sensors on single FireBUS line for iSWAY-FC-D® (protection of 30 floors).
5. Each remote P-MACF sensor must have Fire Alarm Signal (FAS) provided - only one P-MACF sensor located at the fire floor or the closest one is activated providing constant pressure differential measurement to control iSWAY-FC-D® unit.
6. In case of fire-fighting lobbies equipped with electronically controlled air transfer remote P-MACF sensors shall be replaced with regulator MAC-D Min, which controls the air supply damper in the lobby and on the by-pass. MAC-D-Min with integrated pressure transducer with pressure measurement tubes connection points receives Fire Alarm Signal (FAS). In this option control signal for the regulator is the actual value of the pressure differential between the lobby and corridor.
7. iSWAY-FC® unit designed to protect fire-fighting lobbies, lobbies with air transfer, protection of staircase (forced airflow PDS or reversible flow PDS) operating as the additional air supply unit or protecting lift shafts (with regulators MAC-D-Min is equipped with control system type “D” [FC-D]).
8. iSWAY-FC® unit designed to protect high rise staircases (reversible flow PDS), is equipped with control system type “R” [FC-R].

The above technical solution reduces total power supply and communication cables length, the demand for electricity and eliminates the need for pressure regulating dampers that take up a lot of space along with its automation. Described solution also increases the performance of iSWAY-FC® device in the case of pressure criterion (no additional resistance to the partially closed dampers - at the given time the fan supplies precisely set airflow rate required to produce and control overpressure in the protected space.

Emergency Mode:
In the case of communication loss of iSWAY-FC® unit with P-MACF remote pressure sensor, unit is automatically switched to the emergency mode, which covers pressure control in the air supply shaft. Pressure in the shaft is regulated based on learned parameter values during normal operation of the device.
Thanks to a compact structure and small size, the devices from iSWAY-FC series units can be located in almost any place, both indoors and outdoors. A wide range of air supply fans with different capacities and available pressures enables number of possible locations at any floor of the building at the roof or at the ground level.

Figure 8. Example of locating the iSWAY-FC® unit on the roof.

Note:

1. TSS - Control - Signal Board - to be placed at the fire brigades access level, near the building entrance.

2. For complex PDS the MSPU (Operating Conditions Monitoring Device), and TS (Control Board) should be used, located in the monitoring room (near the building entrance).

3. Total length of the pulse tube up to 12 m.

4. In the case where length of the impulse tubes would exceed 12 m, the remote P-MACF pressure sensor should be used.

5. The applicability of the concentrated air supply should be analyzed for each case, considering local technical conditions in the building and design PDS performance class.
**iSWAY-FC®** - compact pressurization unit with integrated control system

### Location in the building and units options

![Diagram](image)

**Note:**
1. TSS - Control - Signal Board - to be placed at the access level of firefighting and rescue services, near the entrance.
2. For complex systems the MSPU (Monitoring of Working Conditions of Machines) and TS (Control Board) should be used, placed in the monitoring room.
3. The maximum length of the pulse cables equal to 12m.
4. In the case where length of the impulse tubes would exceed 12m, the remote P-MACF sensor should be used.
5. The applicability of the concentrated air supply should be analyzed for each case, considering local technical conditions in the building and adopted class of pressure differentiation system.

### Possibilities for the device installation

To facilitate the design and assembly, unit design is based on the self-supporting structure with amortized fan in such a way that allows work in any position (horizontal and vertical). It is recommended to determine the direction of installation either 1 or 2, to avoid positioning components of the control system in the upside down position. The upside down position of automation is accepted in the situation when device working position is not known, however, the position of power supply inside the device must be changed. If the direction of assembly is not possible to determine, iSWAY-FC® unit is typically mounted in the direction marked as 1.

![Diagram](image)

**Figure 9.1.** Possible assembly options of the iSWAY-FC® unit

After determining the direction of assembly it is recommended to remove drain holes plugs Ø 14 in the bottom profiles of the device housing. M8 mounting hole locations have been set so to allow to mount iSWAY-FC® unit in any direction according to the Drawing 9.1. Vertical assembly requires a special foot, which is available in range of accessories available for iSWAY-FC® units.
By default iSWAY-FC® units require to intake design rates of the ambient air, providing power supply (guaranteed power supply 3x400V) and Fire Alarm Signal (FAS) and connecting it with TSS or MSPU with TS. It is required to provide pressure differential measurement between the protected space and the reference by connecting pulse tubes to the pressure sensor. If the iSWAY-FC® unit is controlled basing on the measurement in the air supply duct it is necessary to mount the pressure measurement probe at the straight section of the ductwork.

When installing P-MACF sensors, they should be connected by bus loop Local FireBUS with iSWAY-FC-D® unit. Up to three pressure sensors P-MACF can be supplied from the Local FireBUS loop. If more additional power supply must be provided.

In case when P-MACF pressure sensors are located in the fire-fighting lobbies Fire Alarm Signal (FAS) must be supplied to all sensors. iSWAY-FC® is controlled basing on the control signal from the sensor at the fire floor only.

In the case of mounting of iSWAY-FC® units in the facility in the amount of 1 to 3 (without the fire-fighting lobbies), for such system the common Control - Signal Board shall be applied (TSS-1 to TSS-3 respectively). For higher number of devices or complex PDS the use of Operating Conditions Monitoring Device (MSPU) together with Control Board (TS) shall be applied. Both Control - Signal Board (TSS) and Operating Conditions Monitoring Device (MSPU) shall be located at the fire brigades access level [e.g. monitoring room, BMS].

**Control - Signal Board TSS**

Control - Signal Board (TSS) is used to control iSWAY-FC® units and to monitor proper work of the equipment. On the board’s housing there are switches, controls and displays showing pressure value in the protected space. Key switches, are used to manually switch iSWAY-FC®, smoke sensor lock or twin air intake module switch (depending on the iSWAY-FC® unit location) and reset of the Fire Alarm Signal (FAS). Indicators inform on the receiving of the Fire Alarm Signal (FAS), equipment failure, the smoke in the air supply ductwork.

**TSS sizes:**

1. TSS-1 – 200x300x115 mm
2. TSS-2 – 300x300x150 mm
3. TSS-3 – 300x300x150 mm

1 - seven segment display [three segments]
2 - light indicator in red color indicating failure
3 - two-position switch switched by the key, controlling
   fan manual switching
4 - light indicator in yellow color indicating the smoke
   in the air supply ductwork
5 - two-position switch switched by the key controlling
   smoke detector lock or twin air intake module switch
6 - membrane fan
7 - EMC cable pass
8 - light indicator in yellow color, indicating Fire Alarm Signal (FAS)
9 - light indicator in green color, indicating about board power supply
10 - two-position switch switched by key controlling
    Fire Alarm Signal (FAS) reset
11 - UNI cable pass
12 - wall bracket

---

**Figure 10. TSS-1 - general view**
iSWAY-FC® - compact pressurization unit with integrated control system

**Equipment**

**Operating Conditions Monitoring Device (MSPU)**

Operating Conditions Monitoring Device (MSPU) is a supplement of the SMAY Sp. z o.o. offer in the range of smoke and heat control systems. The purpose of the unit is to control the data transmission channels and monitoring of the operating parameters of the key components of the SAFETY WAY® type systems. MSPU board should be installed near the Control Board (TS). MSPU is built-in steel cabinet painted in RAL 3000. Industrial computer monitor is built in the door. The monitor is fitted with touch panel, which allows to call different functions of the monitoring system.

Operating Parameters Monitoring Device (MSPU) is used to visualize operating conditions of the executive components of the PDS. Visualizations (individual graphics) are created individually for each PDS (for its size, type and number of protected spaces). MSPU allows for quick and easy diagnose of possible malfunction and its location, and also reduces the testing time (acceptance testing, maintenance works) of the PDS operation by displaying all work parameters of each device that form part of it.

**Control Board (TS)**

Control Board (TS) is always mounted in the building along with MSPU. On the board there are control lights confirming supply of power to the board, receiving Fire Alarm Signal (FAS) and collective failure signal. This board must be installed in the access point of emergency services. On the TS board there is a common switch “manual fan switching” which causes all devices to run. Since each unit can be individually stopped from the TS board - there is a possibility to switch on individual device or any group of devices. Each device has the Fire Alarm Signal (FAS) reset switch installed that allows to stop the device. After receiving a signal about the fire the iSWAY-FC® unit works independently and require to be stopped. With this switch we can also stop the device preventing it from working. For safety reasons, this switch is fitted with key lock. There is a switch for each device (smoke detector locks or a twin air intake module switch). This switch has two alternate functions depending on whether the given equipment has double air intake module switch. If there is a twin intake, after occurrence of smoke, switching to alternative air intake ductwork takes place automatically in the control room, and the switch allows for return to the original source. In the event that there is no twin air intake module available the occurrence of smoke in the air supply ductwork automatically stops the device. Switch allows then to ignore the information about the smoke and causes the operation of the device. Confirmation of smoke occurrence in the duct is displayed on the MSPU board located near the TS.
iSWAY-FC® - compact pressurization unit with integrated control system

**Equipment**

**Remote P-MACF pressure sensor with the Fire Alarm Signal (FAS) input**

P-MACF is a digital converter of pressure difference, equipped with one pressure difference sensor and connector designated to supply power and for data transmission via two Local FireBUS channels.

Built in, internal microprocessor system performs linearity correction while taking into account, inter alia, operating temperature, and characteristics entered at the time of calibration. High accuracy and stability of measurement is ensured by the use of sophisticated calibration equipment and long-term aging process of the elements of the machine. The converter is designed to measure air pressure with small degree of contamination.

Remote pressure sensor mounted in a number of cases, is a part of the PDS:

1. When the iSWAY-FC® device is located away from protected space and the impulse tubes length required would be greater than 12 m, then the P-MACF sensor is used connected to iSWAY-FC-D® bus loop Local FireBUS. In case of loss of communication by the unit with the P-MACF sensor, iSWAY-FC-D® unit switches to emergency control on the basis of measurements from the internal P-MACF pressure sensor located inside iSWAY-FC-D® unit’s housing or on the basis of programmed control value.

Dimensions P-MACF: 180x122x90mm

2. In the case of protecting fire-fighting lobbies without electronically controlled air transfer - in the lobbies there are P-MACF sensors mounted connected with iSWAY-FC-D® unit via bus loop Local FireBUS. Each regulator is supplied with 24VDC power supply and Fire Alarm Signal (FAS). P-MACF sensor has terminals for impulse signals enabling pressure differential measurement. The maximum number of sensors (addresses) on the loop is 32, except that the 2 addresses are reserved for iSWAY-FC-D® unit which pressurizes fire-fighting lobbies. In case of fire, P-MACF sensor at the fire floor a Fire Alarm Signal (FAS), and iSWAY-FC-D® unit controls the overpressure in the fire-fighting lobby at the fire floor basing on the signal from this sensor only.

In the event of loss of communications of iSWAY-FC® unit with the P-MACF sensor, iSWAY-FC® unit switches automatically to emergency mode, consisting of pressure control in the air supply shaft. Pressure in the air supply shaft is controlled on the basis of value parameters learned during normal operation.
**iSWAY-FC® - compact pressurization unit with integrated control system**

**Equipment**

**Digital pressure regulator MAC-D Min**

In case of protection of the fire-fighting lobbies equipped with electronically controlled air transfers to the corridors – in the lobbies there are MAC-D-Min regulators mounted, that controls the operation of air dampers in the lobby and in the transfer ductwork. The regulator has a terminals of pneumatic signals from static pressure measuring points in the fire-fighting lobbies and in the corridor. Similarly to P-MACF it is connected to iSWAY-FC-D® unit by bus loop of Local FireBUS. Each regulator is supplied with 24VDC power supply. The maximum number of sensors (addresses) on the loop is 32, except that the 2 addresses are reserved for iSWAY-FC-D® unit which pressurizes the lobbies. In case of fire, P-MACF sensor from the fire floor receives Fire Alarm Signal (FAS), and iSWAY-FC-D® unit controls the pressure in the lobby (shaft) based on the measurement from this sensor only.

Dimensions Mac-D Min 180x250x90mm

**Connecting box PZ**

To connect the actuators with MAC-D Min regulator, connecting boxes PZ are used. There are four types of boxes: PZ1, PZ2, PZ3 and PZ4. To PZ1 box - 1 NMQ24A-SR actuator can be connected, to PZ2 – 2 NMQ24A-SR actuators, to PZ3 - 3 NMQ24A-SR actuators, to PZ4 - 4 NMQ24A-SR actuators. Each PZ box is supplied with 24VDC (power usage depends on the number of actuators on the regulating multiblade air dampers).

**Temperature sensor T-MAC**

In the SAFETY WAY® forced airflow PDS the direction of the flow in the pressurized staircase is determined by the MAC-FCR regulator by measuring the temperature outside the staircase, and inside the staircase. For temperature measurements in such PDS installed in high-rise buildings the T-MAC digital temperature converters are used connected with iSWAY-FC-R® units by bus loop of Local FireBUS.

**NOTE:**

At the conceptual design stage, the locations of static pressure measurement points, both in the space protected by overpressure, as well as reference pressure should be explicitly determined. Moreover routes of the impulse tubes shall be designed. It is necessary to provide properly sized air release path from the fire floor required to achieve design pressure differential and directed airflow through the evacuation door.
iSWAY-FC® - compact pressurization unit with integrated control system

Structure

Housing
The body of the device is a construction made of aluminum profiles, filled with steel panels painted with RAL color of your choice, isolating layer of the housing is made of 40 mm thick mineral wool. Access to the various components of the device is enabled through the removable inspection panels.

Fan – Frequency Inverter
Fan powered by a frequency converter supplies air to the protected space. In order to ensure a rapid decrease of fan efficiency, the device is fitted with system of resistors, receiving energy from the fan during braking.

Shut-off damper
Inside of the device is also protected against chill and ingress of contamination by using thermally isolated shut-off damper with actuator located on the air intake side. In order to increase the reliability of the device, the shut-off damper actuator is equipped with a return spring. In case of power failure (e.g. caused by cable route damage), the shut-off damper switches to the fully open position (safe), allowing aeration of space protected by overpressure.

Smoke detector in the duct housing
All devices from iSWAY-FC® series are equipped with a smoke detector located inside the housing that informs about the possibility of secondary smoke transport to the protected space. When the smoke is detected the unit is automatically turned off or an optional alarm is reported informing about the risk of sucking in the smoke.

Main switch
There is also a main switch located on the housing of the device, which is used to manually disconnect power supply during maintenance work or emergency stoppage of the unit.

Connection points of impulse probes
In order to supply the device with the pressure from the protected and reference space, there are connection points mounted in the form boxes.

24VDC Power Supply
The iSWAY FC device is equipped with 24VDC power supply for its own needs. The power supply is also equipped with UPS type battery power.

MAC-FC(R) Regulator
MAC-FC® regulator is an electronic device controlled by processor. The regulator is used to control the pressure differentiation systems in accordance with the requirements specified in PN-EN 12101-6. It ensures compliance with the requirements of item 5.4.2.5. “Variable supply fans or dampers controlled by pressure sensors shall not be used unless the system can achieve over 90 % of the new air supply requirements within 3 s of a door being opened or closed.”

MAC-FC® controls the fan through the inverter, based on a pressure reading from the pressure sensor. Regulator chooses automatically state of operation of the installation depending on the state of its inputs, and displays it on cooperating device.

Power Supply - Control Cabinet - SZA-FC
SzA-FC cabinet is an element that supplies iSWAY-FC device components with power and controls the dampers on the basis of information from the MAC-FC® regulator. On the cabinet cover there is information displayed “Power supply control 3x400VAC and 24VDC” Inside, there is also protection of the individual power outputs for devices.
iSWAY-FC® - compact pressurization unit with integrated control system

Structure

Anti-Frost System

The new version of iSWAY-FC® units introduces system preventing shut-off dampers from freezing in extremely low temperatures. To seal the dampers a specialist sealing system resistant to low temperatures was used. Also used was directional radiator (IR heater) system that is switched on automatically according to the set and measured temperature. Elements that are key to the proper operation of the dampers at a low temperature are made so to provide the maximum absorption of radiation in order to raise its temperature above the freezing point. Other interior elements of iSWAY-FC® are made so that they reflect radiation.

Figure 11. Structure of iSWAY-FC® compact pressurization unit

1. Housing
2. Infrared radiator AF OPTION
3. Volumetric airflow rate measurement bar
4. Fan
5. The braking resistor
6. Shut-off damper (air supply)
7. Inspection panel
8. Smoke detector
9. Frequency inverter
10. Control cabinet
11. Terminal of the reference static pressure measurement point
12. Terminal of the protected space static pressure measurement point
13. Master switch
14. Shut-off damper actuator
15. Electrical cabling duct
16. Thermostat SP OPTION
17. Pressure sensor
18. Regulator
19. 24VDC feeder
20. Terminals of the control cables and communication BUS output points
**iSWAY-FC® - compact pressurization unit with integrated control system**

**Principle of operation**

The object of the control is the escape space, e.g. staircase pressurized by frequency inverter driven air supply fan. The inverter supplied from the power network sends to the fan motor alternating voltage with frequency inverter in the range 0 to 50 Hz signal. This enables precise control of the motor rotational speed i.e. fan capacity. The inverter receives a controlling signal from the regulator, which corresponds to the frequency of 0 to 50 Hz. The control strategy is based on the assumption of nominal precise control (set) value of 50 Pa of static pressure differential between the protected and the reference space based on the continuous measurement of this value carried out with P-MAC pressure sensor [F]. Although the control system is able to recognize presently realised criterion (pressure / airflow) the primary goal is to produce and control the nominal value of the differential pressure regardless of whether escape door are opened or closed. This goal is achieved by automatically adjusting capacity of the air supply fan equipped with frequency inverter in the function of actual air leakage rate of the protected space. This function of the control system is based on the assumption that the overpressure of 50 Pa is considered safe in the context of the maintaining the escape routes free from smoke. Both normative criteria are recognised on the basis of the measured differential pressure. In the situation where the total capacity of the air supply fan is not sufficient to cover air leakage of the protected space the decrease in overpressure value occurs. The most innovative feature of the MAC-FC regulator is the use of a predictive algorithm based on the use of neural networks. Such approach allows for automatic change of the regulator settings in the hydraulic characteristics function change of the protected space, without any manual intervention. This is particularly important in the case of unit functioning in the real building during the fire, when unforeseen events, such as cracked window can significantly affect the performance of the pressure differential system (PDS).

Performed tests showed that iSWAY-FC® compact pressurization unit equipped with the MAC-FC regulator is able to generate and precisely control the nominal value of the differential pressure as well as to automatically adapt to changes entered during test procedure (range of fan capacity min / max, and the range of leakage values min / max).

The iSWAY-FC® unit was tested in a I.F.I. Institute for Industrial Aerodynamics in Aachen, Germany in accordance with the current test procedure constituting part of the revised European standard revEN 12101-6.

The tests were conducted for the largest unit of the type of series with 15 kW motor for the air supply fan capacity of 48 500 m³ / h, in the range of leakage from 300 m³ / h to 36 000 m³ / h. Positive test results were obtained in all tests, i.e. the fulfillment of norm requirements in the field of response time, precise control of the pressure difference, the reliability and stability against oscillations.

In the course of the tests no changes were introduced to regulator settings, which clearly demonstrates its full adaptability in the tested range of airflows.

**Reliability of the device – test**

In order to obtain the highest level of reliability of the unit (pressure differential kit), thus increase in safety, the test programme was introduced. Once every 24 hours, the MAC-FC regulator opens the shut-off damper in addition, activates the fan for 15 seconds on low frequency value. During that time, it is checked whether shut-off damper reached fully open position, and whether inverter-fan set works correctly and none of the devices report errors. The test result is archived in the regulator memory. Moreover periodical tests results can be easily printed in the form of the report.
iSWAY-FC® - compact pressurization unit with integrated control system

Principle of operation

Figure 12. Official summary of the test parameters of iSWAY-FC® unit.
iSWAY-FC® - compact pressurization unit with integrated control system

**Operation modes**

The task of the control, i.e. the goal to be achieved by means of the regulator is set for the two determined states:

1. **Door closed**: nominal overpressure in the protected space is maintained in the range of 50 Pa with tolerance +/- 20% (nominal overpressure can be set to different values depending on the design objectives).
2. **Door opened**: the set speed of airflow in the doorway should be maintained on a minimal level e.g. 1 m/s (evacuation) or 2 m/s (rescue action).

Opening the door causes the transition from state (1) to state (2), the closure from (2) to (1). The dynamic change occurring between steady states (1) and (2) is called the transient state. Each of the transient states should last no longer than 3 seconds.

The control system in accordance with the principle “we do not realise fire scenarios, but rescue human life” should realise control task in all conditions, regardless of the number of open / partially closed doors, broken windows, etc. The leak can change rapidly (e.g. breaking of window) or smoothly (e.g. action of door closer on the floor not covered with fire).

**Communication and control**

For the needs of the fire system communication protocol FireBUS was developed and implemented [monitoring and control].

In the SAFETY WAY® system the 2 FireBUS loops can be distinguished:

1. „**Global FireBus**“ interconnects in the loop MAC-FC (R) iSWAY-FC (D) (R) and TSS or TS regulators (depending on system configuration).
   - the transfer of Fire Alarm Signal (FAS) information between devices,
   - gathering information about the work of the various components of the system, transferring them to the TSS or MSPU,
   - transfer of signals to the system devices from manual TSS and TS switches.

2. „**Local FireBus**“ interconnects in the loop MAC-FC (R) iSWAY-FC (D) (R) regulators, remote P-MACF pressure sensors, Min MAC-D regulators, and T-MAC temperature sensors.
   - Communication between MAC-FC regulator and P-MACF sensors, with which it interoperates.

Local and Global FireBUS have a loop topology. Thanks to this solution, a single damage (e.g., burnout, wire breakage, regulator or sensor failure) does not cause interruption in communication in the system.
iSWAY-FC® - compact pressurization unit with integrated control system

Dimensions and weight

Figure 13. External dimensions of the iSWAY-FC® unit.

Table 1. Summary of dimensions of the iSWAY-FC® units.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1500</td>
<td>1050</td>
<td>850</td>
<td>425</td>
<td>380</td>
<td>770x770</td>
<td>600x600</td>
</tr>
<tr>
<td>1</td>
<td>1600</td>
<td>1300</td>
<td>1080</td>
<td>540</td>
<td>510</td>
<td>1000x1000</td>
<td>800x800</td>
</tr>
<tr>
<td>2</td>
<td>1700</td>
<td>1500</td>
<td>1280</td>
<td>640</td>
<td>610</td>
<td>1200x1200</td>
<td>1000x1000</td>
</tr>
</tbody>
</table>

Table 2. Summary of hydraulic and electrical parameters.

<table>
<thead>
<tr>
<th>Type</th>
<th>Capacity [m³/h]</th>
<th>Available static pressure [Pa]</th>
<th>Power supply [V]</th>
<th>Active power [kW]</th>
<th>Apparant power [kVA]</th>
<th>Protection inside of the device</th>
<th>Suggested protection in the switchboard</th>
<th>Suggested power supply cables</th>
<th>Weight [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.3</td>
<td>3000</td>
<td>900</td>
<td>3x400</td>
<td>3.4</td>
<td>3.8</td>
<td>FWC-10A10F</td>
<td>gG 16 A</td>
<td>NHXH FE180/E90 5x2,5</td>
<td>320</td>
</tr>
<tr>
<td>0.12</td>
<td>12000</td>
<td>550</td>
<td>3x400</td>
<td>5.4</td>
<td>6</td>
<td>FWC-16A10F</td>
<td>gG 20 A</td>
<td>NHXH FE180/E90 5x4</td>
<td>340</td>
</tr>
<tr>
<td>1.17</td>
<td>17000</td>
<td>390</td>
<td>3x400</td>
<td>5.4</td>
<td>6</td>
<td>FWC-16A10F</td>
<td>gG 20 A</td>
<td>NHXH FE180/E90 5x4</td>
<td>350</td>
</tr>
<tr>
<td>1.20</td>
<td>20000</td>
<td>400</td>
<td>3x400</td>
<td>7.3</td>
<td>8,1</td>
<td>FWC-16A10F</td>
<td>gG 20 A</td>
<td>NHXH FE180/E90 5x4</td>
<td>350</td>
</tr>
<tr>
<td>1.24</td>
<td>24000</td>
<td>400</td>
<td>3x400</td>
<td>9.6</td>
<td>10,7</td>
<td>FWC-20A10F</td>
<td>gG 25 A</td>
<td>NHXH FE180/E90 5x6</td>
<td>550</td>
</tr>
<tr>
<td>2.31</td>
<td>31000</td>
<td>410</td>
<td>3x400</td>
<td>9.6</td>
<td>10,7</td>
<td>FWC-20A10F</td>
<td>gG 25 A</td>
<td>NHXH FE180/E90 5x6</td>
<td>735</td>
</tr>
<tr>
<td>2.39</td>
<td>39000</td>
<td>470</td>
<td>3x400</td>
<td>14</td>
<td>15,6</td>
<td>FWC-32A10F</td>
<td>gG 40 A</td>
<td>NHXH FE180/E90 5x10</td>
<td>755</td>
</tr>
<tr>
<td>2.47</td>
<td>47000</td>
<td>430</td>
<td>3x400</td>
<td>18,7</td>
<td>20,7</td>
<td>FWC-40A10F</td>
<td>gG 50 A</td>
<td>NHXH FE180/E90 5x16</td>
<td>770</td>
</tr>
</tbody>
</table>
iSWAY-FC® - compact pressurization unit with integrated control system

**Characteristics**

![Available compression vs Flow graph](image)

**Structure performance options**

The basic version of the iSWAY-FC® unit is the compact housing (Figure 16.) designated to be assembled outside e.g. roof level, ground level or technical room (ventilation engine room) optionally with twin-air intake module (Figure 17.).

Among other default versions of iSWAY-FC® units, is a version with air intake module (Figure 18.) and the smallest unit “0” designated for vertical assembly with adjustable air intake module (Figure 19.).

In order to achieve the declared capacity of the air supply fan, directly next to the unit in the direction of the airflow there should be a section of straight duct with minimum length equal to the diameter of the air supply fan applied. If local technical conditions allow it is recommended to use straight section of 1 m in length.
iSWAY-FC® - compact pressurization unit with integrated control system

Structure performance options

Figure 15. Basic version of the iSWAY-FC® unit with flexible connectors (KE) at the air intake/supply sides (ductwork assembly version).

Figure 16. iSWAY-FC® unit with additional twin-air intake module (roof top assembly).

Figure 17. iSWAY-FC® with additional air intake module.
iSWAY-FC® - compact pressurization unit with integrated control system

Structure performance options

Figure 18. Vertical assembly version of the smallest „0” iSWAY-FC® unit – adjustable air intake closed

Figure 19. Vertical assembly version of the smallest „0” iSWAY-FC® unit – adjustable air intake opened
iSWAY-FC® - compact pressurization unit with integrated control system

Electrical and communication connections

Figure 20. Block diagram of the connection of TSS-1 Board with a single iSWAY-FC® unit.

Figure 21. Block diagram of the connection of TSS-2 Board with two iSWAY-FC® units.

Key

Control – signal board

Multiblade air damper

Measurement of static pressure differential – pulse tubes e.g. PVC Ø 6

Actuator BLE24-Belimo

Control and monitoring room e.g. BMS
iSWAY-FC® - compact pressurization unit with integrated control system

Electrical and communication connections

Figure 22. Block diagram of the connection of TSS-3 Board with 3 iSWAY-FC© units

Key

Control – signal board

Multiblade air damper

Actuator BLE24-Belimo

Measurement of static pressure differential – pulse tubes e.g. PVC Ø 6

Control and monitoring room e.g. BMS

1x230V 0,5kW
iSWAY-FC® - compact pressurization unit with integrated control system

Electrical and communication connections

**Fire-fighting lobby with electronically controlled air transfer**

**Staircase**

**Lift lobby**

**Rescue lift shaft**

**Figure 23. Exemplary block diagram of the expanded SAFETY WAY® pressure differential system**

[Diagram showing electrical connections and components]

Fire-fighting lobby with electronically controlled air transfer

```
version 5.2.6

Electrical and communication connections

Fire-fighting lobby with electronically controlled air transfer

Staircase

Lift lobby

Rescue lift shaft

**Figure 23. Exemplary block diagram of the expanded SAFETY WAY® pressure differential system**

[Diagram showing electrical connections and components]
```
**Assembly on site**

The unit must be assembled in such a way as to avoid conflict of associated installation (ductwork, cable routes) with inspection panels. In order to perform proper installation, minimum distances should be kept (Fig. 26) between the service side and the existing at the installation site fixed building elements (walls, supports, pipework, etc.). It is also important for the operation of the device and the possibilities to perform service - maintenance works. Mounting of the following installations in the service space is allowed: pipelines, supporting structures disassembly and assembly of which for the duration of service works, repairs and overhaul is easy and does not affect the operation of these units.

![Figure 24. Minimum distance of iSWAY-FC units from fixed structural elements](image)

**Twin-Air Intake Module**

**REQUIREMENTS FOR DUCTWORKS SUPPLYING THE AIR TO THE UNIT [FROM THE INTAKE] – TWIN-AIR INTAKE MODULE**

Air intake shall be provided for drawing air in from outside the building in such a way that it is not contaminated by smoke from a fire within the building. Air intake (intake) should you always be positioned away from any potential fire hazards. In order to avoid contamination by the rising smoke, it is recommended to locate air intakes at the ground level or close to it (but well away from the basement smoke vents). If it is not possible, air intakes should be positioned at the roof level. It is essential that the air supply used for pressurization is never in danger of contamination by smoke. If the air intake is located at the roof level it is obligatory to provide smoke detector in the supplying ductwork to cause automatic shutdown of the air supply fan. For the needs of the fire brigades carrying out rescue action manual override switch operating the air supply fan shall be provided.

Where air intakes are positioned at roof level there shall be two air intakes (twin-air intake module), spaced apart and facing different directions in such a manner that they could not be directly downwind of the same source of smoke. Each inlet shall be independently capable of providing the full air requirements of the system. Each inlet shall be protected by an independently operated smoke control damper system in such a way that if one damper closes due to smoke contamination, the other inlet will supply the air requirements of the system without interruption.

The discharge point of a smoke ventilation duct shall be a minimum of 1 m above the air intake and 5 m horizontally from it. Manual override switch to reopen the closed damper and to close the open damper shall be provided for fire brigade use.
Twin-Air Intake Module

Manual override switches of pressure differential system should be located in the following locations:

a) engine room or engine room of the pressure differential system (if separated), and
b) near the entrance to the building, at the site agreed with the supervisory authorities.

These switches after activating should be locked in the “on” position, and should be designed so that their return to the “off” position can only be made by authorized personnel (e.g., by staff or by using code lock).

Working independently system of shut-off dampers (default and alternative) to control the spread of smoke is offered by SMAY company under the name of Twin-Air Intake Module. This set consists of two separate motorized smoke dampers with actuators protected from the weather conditions with removable inspection panels to provide service and maintenance and additional automation module located in the Power Supply-Control Cabinet. Twin-air intake modules are offered in the default type of series of sizes corresponding to the size of flexible inlet adapters of iSWAY-FC® units.

Identification

Rating plate with a list of basic information on the given device is placed on the housing of each iSWAY-FC® unit.

Typ – specifies the device’s technical specifications, e.g. FC 1.20
S/N – serial number
Rok – production year
V – capacity of the air supply fan at given available static pressure Δp
P – electric power of the device [kW]
iSWAY-FC® - compact pressurization unit with integrated control system

Accessories and placing order

When ordering iSWAY-FC® unit, information should be given according to the following procedure:

\[
iSWAY - FC <A> - <WYL > - <X> - <T>/<ADD>
\]

Where:

\(<A>\) - automation

- none = standard automation
- D – for use in the Local FireBUS Loop
- R – for the reversible flow system [SAFETY WAY® type]

\(<W>\) - the size of unit’s housing [mm]:

- 0 – dimensions: 1500 x 1050 x 850
- 1 – dimensions: 1600 x 1300 x 1080
- 2 – dimensions: 1700 x 1500 x 1280

\(<V>\) - fan capacity at available static pressure of 300 Pa

- 3 – capacity 3000 m³/h
- 12 – capacity 12000 m³/h
- 17 – capacity 17000 m³/h
- 20 – capacity 20000 m³/h
- 24 – capacity 24000 m³/h
- 31 – capacity 31000 m³/h
- 39 – capacity 39000 m³/h
- 47 – capacity 47000 m³/h

\(<X>\) - service side

- none = right side
- L – left side

\(<T>\) - operation temperature

- none = od -5 do +50 °C
- AF - od -25 do +50 °C - equipped with Anty Frost system

\(<ADD>\) - accessories:

- KE - flexible adapter on the intake side
- CP - air intake
- UP - twin-air intake module
- DA - automatic roof [for W=0]
- SS - placing on welded feet – horizontal assembly
- BF - placing on Big Foot - horizontal assembly
- KM - fixation with angle bars - horizontal assembly
- RS - placing on welded frame – horizontal assembly
- SW - placing on self-aligned foot – vertical assembly with top air intake
- PSW - placing on platform and self-aligned foot

Example of order:
\[iSWAY-FC-D-1.20 / KE, BF\]

When ordering TSS-1, TSS-2, TSS-3, TS, MSPU, T-MAC, P-MACF, MAC D Min, PZ and actuators the number of pieces shall be given.

Example of order:
\[TSS-1 - 1 szt
T-MAC - 8 szt
P-MACF - 16 szt\]

**NOTE:** Smay LLC company, with orders of more than 3 iSWAY-FC devices designated to handle a single object, recommends Monitoring of Working Conditions of Machines (MSPU) along with the Signal Board (TS), which allow for the integration and central monitoring of aeration unit. Unit’s housing bar is painted in RAL 7043 mat [traffic grey B] other elements of the housing are painted in RAL 9006 mat [white aluminum].