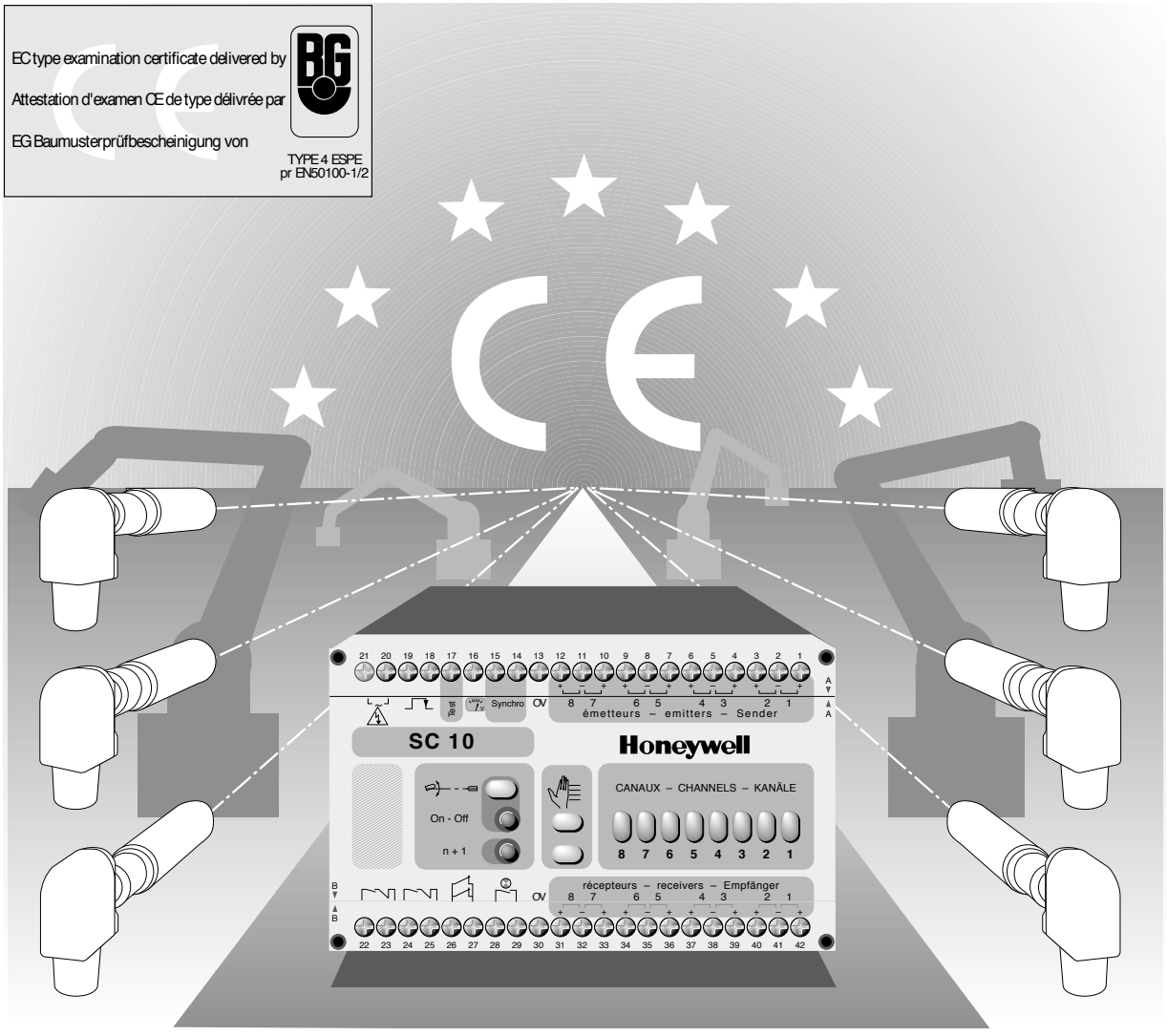
English

# FF-SCAN Series

## Installation and maintenance manual




Photoelectric safety curtain
Long range / modular
for protection of workers / operators

**⚠ WARNING**

**IMPROPER INSTALLATION**

- Consult with US and/or European safety agencies and their requirements when designing a machine control link, interface and all control elements that affect safety.
- Strictly adhere to all installation instructions. **Failure to comply with these instructions could result in death or serious injury.**



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# Table of contents

# 1. Statutory provisions

## *1.1 Overview*

This section contains important highlighted information related to the FF-SCAN Series modular safety light curtains.

## *1.2 Definitions*

Important danger and warning information is defined as follows:

**⚠ DANGER**

A DANGER symbol indicates an imminently hazardous situation, which, if not avoided, will result in death or serious injury.

**⚠ WARNING**

A WARNING symbol indicates a potentially hazardous situation, which, if not avoided, could result in death or serious injury.

## *1.3 Important Highlighted Information*

**⚠ DANGER**

**FULL REVOLUTION MECHANICAL POWER PRESSES CANNOT BE STOPPED IN MID-STROKE (OSHA 29CFR 1910.217).**

Do NOT use FF-SCAN Series modular light curtains on full revolution mechanical power presses.

**Failure to comply with these instructions will result in death or serious injury.**

**⚠ DANGER**

**IMPROPER POINT-OF-OPERATION PROTECTION**

Do NOT use FF-SCAN Series modular light curtains in point-of-operation applications.

**Failure to comply with these instructions will result in death or serious injury.**

**⚠ WARNING**

**IMPROPER INSTALLATION OF FF-SCAN SERIES MODULAR LIGHT CURTAIN**

- Install FF-SCAN modular light curtains in accordance with this installation manual and applicable local safety regulations (OSHA, ANSI, European standards).
- Allow entry into protected area by interruption of sensing field or other safeguarding device only.
- Consult local safety agency before installing FF-SCAN Safety light curtains.

**Failure to comply with these instructions could result in death or serious injury.**

**⚠ WARNING**

**IMPROPER SYSTEM PERFORMANCE**

- Consult local safety agency before designing a machine control system.
- Comply with local safety requirements when designing machine control link, interface and all control elements that affect safety.
- Install two independent safety relay contacts into machine control stop circuit controlled by FF-SCAN Series modular light curtain.
- Ensure two independent stop circuit relays have mechanically linked contacts that prevent contact overlapping in the event of a welded contact.

**Failure to comply with these instructions could result in death or serious injury.**

**⚠ WARNING**

**IMPROPER MACHINE REACTION**

- Ensure the machine control is capable of stopping the machine at any point in the cycle.
- Ensure that a loss of power does NOT impair stopping action of machine.

**Failure to comply with these instructions could result in death or serious injury.**

**⚠ WARNING**

**IMPROPER PERIMETER PROTECTION ACTIVATION**

- Design control circuit that requires a manual restart before further machine operation can occur.
- Locate manual restart to allow operator a clear view of danger zone.
- Operator must NOT be able to reach manual restart from within danger zone.
- Design control circuit to prevent Programmable Logic Controller from overriding manual restart.

**Failure to comply with these instructions could result in death or serious injury.**

**⚠ WARNING**

**REFLECTIVE SURFACES**

To prevent two optical paths to the receiver, install FF-SCAN modular light curtains so there are no reflective surfaces within the beam angles of the emitter and receiver.

**Failure to comply with these instructions could result in death or serious injury.**

**⚠ WARNING**

**ELECTRICAL SHOCK**

Properly ground FF-SCAN Series modular light curtain housing by connecting earth ground through the connector.

**Failure to comply with these instructions could result in death or serious injury.**

**⚠ WARNING**

**IMPROPER INSTALLATION**

Strictly adhere to all electrical connection instructions.

**Failure to comply with these instructions could result in death or serious injury.**

**⚠ WARNING**

**IMPROPER SYSTEM PERFORMANCE**

Ensure independent stop circuit safety relays have mechanically linked contacts that prevent contact overlapping in the event of a welded contact.

**Failure to comply with these instructions could result in death or serious injury.**

## *1.4 Conformity to the European Directives*

The EC type examination certificate granted by the Berufsgenossenschaft E+MIII guarantees the conformity of the product with respect to the essential requirements of the following EC Directives:

- Machine Directive 98/37/EC
- Low Voltage Directive 73/23/EC
- Electromagnetic Compatibility Directive 89/336/EC as amended 91/263/EC, 92/31/EC, 93/108/EC and 93/97/EC.

An EC declaration of conformity is enclosed in this product installation manual.

## *1.5 Use*

**Conditions of use**

- Modular light curtains may be used as principle protection for punches or machines where the movement of the functional parts can be interrupted at any moment in a dangerous phase.
- Modular light curtains can only be used as principle protection on machines on which the control circuit has been designed in such a manner that a fault in one component does not result in any risk.
- Modular light curtains cannot be used as principle protection for machines operating continuously or automatically.
- Modular light curtains are protective devices that output stop signals, not control signals.
- Cancellation of the modular light curtain stop signal must not cause the re-start of moving parts. A restart may only be initiated by means of a control designed for this purpose.

**Additional protection**

In some applications, it may be necessary to provide additional protection to that of the safety barrier. Material screens or more safety barriers can be used, in such a way that the operator is obliged to pass through the detection field in order to enter the danger zone, and is not able to stay between the danger zone and the safety barrier.

Additional protection must be placed and be of such dimensions that it will not permit an operator to reach the danger zone via the **top**, the **bottom**, the **rear** and **laterally**.



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**Additional protection devices will have to be:**
- fixed (fitted with the aid of a tool, or welded if possible);
- or automatically positioned and checked, if their opening is necessary.

It must not be possible for operators to neutralize the detectors associated with these additional protection devices.

## *1.6 European standards compliance*

The installation of a photoelectric safety barrier is subject to very strict rules which may vary from country to country. Correct installation is necessary to ensure safety and must be carried out according to the applicable local standards.

| Standard | Title |
|---|---|
| EN 292 | "Safety of Machinery - Basic concepts, general principles for design" |
| EN 60204 | "Safety of Machinery - Electrical equipment of machines" |
| IEC 61496-1/2 | "Safety of Machinery - Electrosensitive Protective Equipments" |
| EN 999 | "Safety of Machinery - The positioning of protective equipment in respect of approach speeds of parts of the human body" |
| EN 294 | "Safety of Machinery - Safety distances to prevent danger zones being reached by the upper limbs" |
| EN 811 | "Safety of Machinery - Safety distances to prevent danger zones being reached by the lower limbs". |

## *1.7 United States Standards Compliance*

| Standard | Title |
|---|---|
| ANSI B11.19 | Safeguarding when Referenced by the Other B11 Machine Tool Safety Standards |
| ANSI/RIA R15.06 | Safety Requirements for Industrial Robots and Robot Systems |

## *1.8 United States Regulations compliance*

| Regulation | Title |
|---|---|
| OSHA 29 CFR 1910.212 | General Requirements for (guarding of) all Machines |

## *1.9 Important remarks on safety*

The photoelectric barrier is only one part of an integrated safety system. A complete safety system can be compared to a chain, where correct functioning of each link is essential for overall security. And as the safety barrier only forms one link, the rest of the system is of the user's or machine manufacturer's responsibility.

Especially with regard to the stop relay, only use fail to safe schemes (if necessary, please consult the safety authorities of your country).

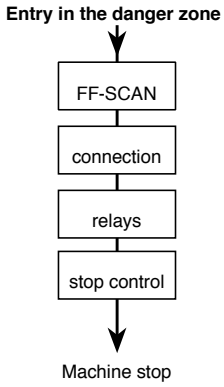


***Figure 1-1***

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# 2. Description of the system

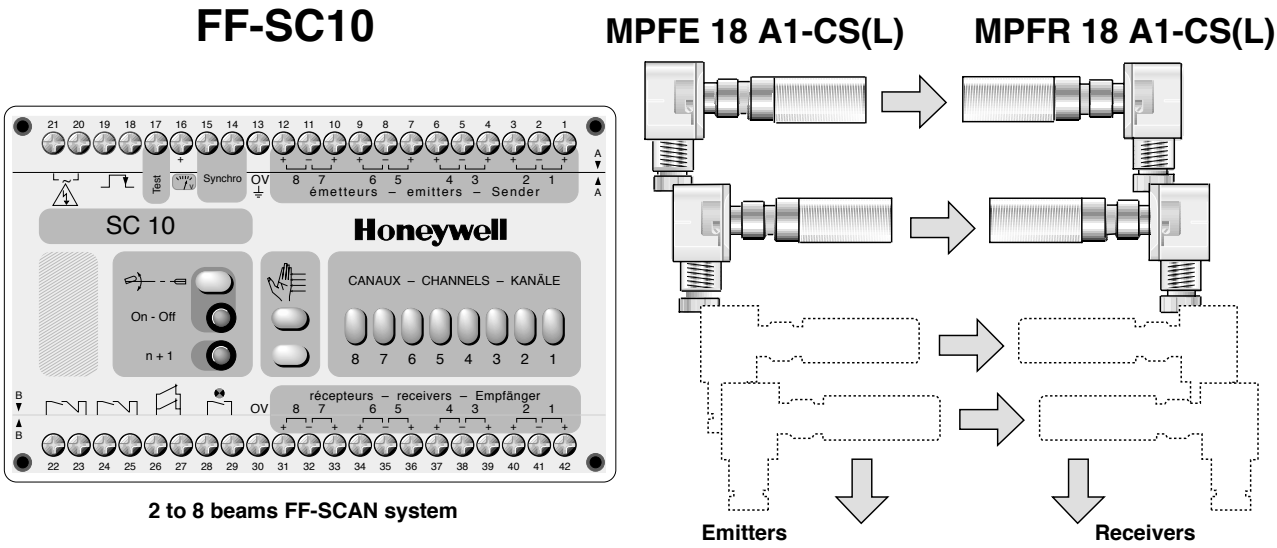


***Figure 2-1***

## *2.1 General*

The FF-SCAN system is a modular photoelectric barrier. Its installation flexibility offers a customised solution in terms of protection of personnel working in or close to danger areas. It consists of two distinct parts, the processing unit, the FF-SC10 amplifier and a certain number of FF-MPF photoelectric sensors.

## *2.2 FF-SC10 Amplifier*

The FF-SC10 is a multichannel photoelectric amplifier and can, through internal configuration, operate from 2 to 8 infrared beams. Along with safety sensors of the FF-MPF type, it allows the installation of safety protection curtains with a range of up to 25 m or 33 m.

**The dynamic design of its electronic processing system along with permanent circuit selfchecking makes it a very high level safety system.**

**The amplifier should be installed in an enclosure minimum rating IP 54. Which needs special tools or a key to gain access. Access being limited to skilled or trained personnel only.**

## *2.3 Operating principle*

The FF-SC10 controls transmission, reception and scanning for each channel, including each output relay.

The control logic is designed around a quartz oscillator through discreet components, (without microprocessor logic). The system also combines an inbuilt beam adjustment function.

## *2.4 FF-MPF photoelectric sensors*

Operating in "SCAN"-mode, the sensors are connected via 3 core shielded cable, maximum length 50 m, using a plug and socket arrangement. The pulsed emitter signal is through a gallium arsenide diode with a wavelength of 875 nm.

The receiver is equipped with a preamplifier of hybrid technology. The built-in impedance adapter provides high immunity of the output signal to electric signals, noises or interference. The beam angle of the optics is ±2°, thus **meeting European safety standards. Sensors protection: IP 67.**

## *2.5 Ordering information*

FF-SCAN□18□□

- Number of beams (2 to 8)
- Max. operating range:
  Blank: 0 m to 25 m
  L: 15 m to 33 m
- Supply voltage:
  E: 120 Vac
  G: 240 Vac
  4: 24 to 48 Vdc

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# 3. Installation instructions

## *3.1 How to calculate safety distances*

The safety distance is the minimum distance between the sensing field of the light curtain and the danger zone. This distance ensures that the danger zone cannot be reached until the machine motion has been stopped.

## *3.2 Safety distances per Europe's EN 999 standard*

In Europe, calculate the safety distance (see Figure 3-1) using the following formula:

**S = K (t1 + t2) + C**

Where:
**S** = Minimum safety distance between the sensing field and the dangerous zone (in mm).
**K** = Approach speed of the parts of the human body directly exposed (in mm/s). Depending on the type of approach and the type of protective device use, 2 values for K are possible : 1600 mm/s or 2000 mm/s.
**t1** = Response time of the FF-SCAN modular light curtain (in s).
**t2** = Stopping time for the machine to stop the dangerous motion (in s).
**C** = Additional safety distance depending on the light curtains resolution R (in mm).

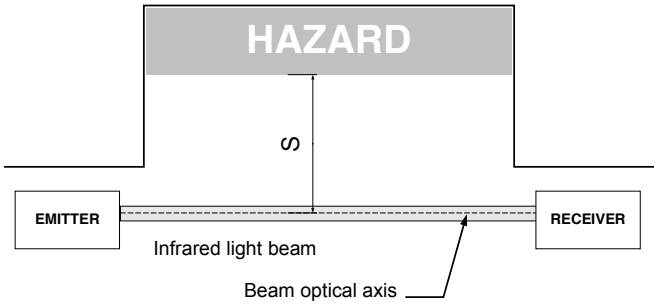



***Figure 3-1 Light curtain safety distance diagram***

### 3.2.1 Light curtain's resolution

The resolution R is determined by the maximum distance between the FF-MPF sensors and the lens diameter.

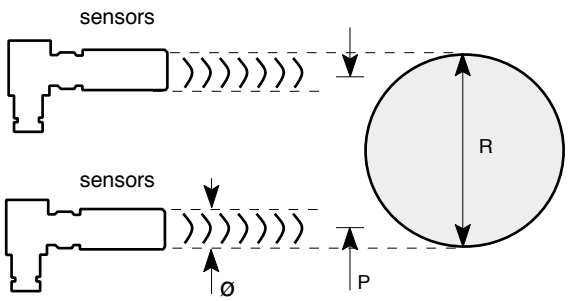



***Figure 3-2***

**R = P + ø**

Where:
**R** = resolution (in mm)
**P** = max. distance between sensors (in mm)
**ø** = lens diameter (in mm)
Notice: For FF-MPF18 sensors, the lens diameter ø is 15 mm.

### 3.2.2 Additional safety distance per EN 999 standard

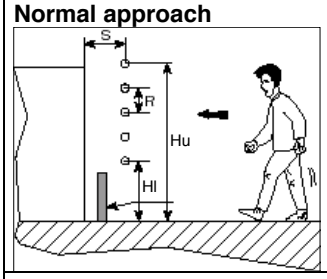
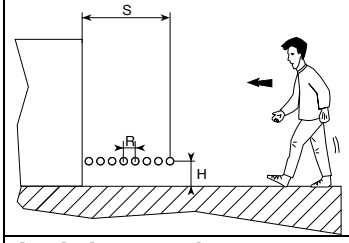
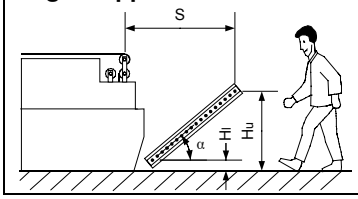
The additional safety distance C is depending on
- the resolution R of the modular light curtain ;
- the type of approach (normal, parallel or diagonal).

The following cases can be distinguished

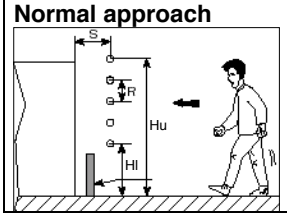
- **Resolution 14 mm ≤ R ≤ 40 mm:**
  C = 8 (R-14), in normal approach, and for an approach angle greater than or equal to 30°.
- **Resolution R > 40 mm:**
  C = 850, in normal approach, and for an approach angle greater than or equal to 30°.
- **For barriers or for multiple individual beams, with a parallel approach:**
  C = 1200 – 0,04 H, H being the height of the detection plane from the ground (in mm).

### 3.2.3 European EN 999 standard

All distances / heights are in mm (100 mm = 3.9 in).

| | **Resolution R ≤ 40** | **Resolution R > 40** |
|---|---|---|
| **Normal approach**<br>  | If S > 100, then use :<br>S ≥ 2000 (t1 + t2) + 8 (R-14)<br><br>If S ≥ 500, then use :<br>S ≥ 1600 (t1 + t2) + 8 (R – 14) | S ≥ 1600 (t1 + t2) + 850<br><br>with Hu ≥ 900<br>Hl ≤ 300<br><br>For access control applications (R > 70) see Note 1 below. |
| **Parallel approach**<br>  | S ≥ 1600 (t1 + t2) + (1200 – 0,4H), with H < 875<br>or<br>S ≥ 1600 (t1 + t2) + 850, with 875 ≤ H ≤ 1000<br>with H ≥ 15 (R – 50) | |
| **Angled approach**<br>  | If α ≥ 30°, then use one of the formula given for the normal approach (depending on the resolution)<br><br>If α ≤ 30°, then use one of the formula given for a parallel approach<br>with Hu ≤ 1000 and Hl ≥ 15 (R – 50) | |

**Note 1: Access detection**
For access detection (resolution > 70 mm), also called body detection, the EN 999 standard specifies the number of beams and their respective height above the reference plane as followed :

| **Access detection** | **Resolution R > 70** | | |
|---|---|---|---|
| **Number of beams** | 2 | 3 | 4 |
| **Beam spacing** | 500 | 400 | 300 |
| **Recommended beam heights above the reference plane per EN 999** | Hl = 400<br>Hu = 900 | Hl = 300 / 700<br>Hu = 1100 | Hl = 300 / 600 / 900<br>Hu = 1200 |
| **Normal approach**<br>  | **S ≥ 1600 (t1 + t2) + 850** | | |



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Where :
S minimum safety distance (in mm, 100 mm = 3.9 in)
t1 light curtain response time (in s)
t2 machine stopping time (in s)
H height of the detection plane above the reference floor (in mm)
Hu height of the uppermost beam above the reference floor (in mm)
Hl height of the lowest beam above the reference floor (in mm).

**For more information, refer to the EN 999 European standard or comply with the requirements on safety distances given by the type C European standard if existing for the considered machine.**

## *3.3 Safety distances per USA's OSHA/ANSI requirements*

In the USA, calculate the safety distance (see Figure 3-3) using the following formula :

**Ds = K (Ts + Tc + Tr) + Dpf**

Where:
Ds is the minimum safety distance from the light curtain sensing field to the danger zone (in in).
K is the approach speed of movement to the danger zone (63 in/s minimum).
Ts is the worst case stopping time of the machine (in s).
Tc is the worst case response time of the machine's control (in s).
Tr is the response time of the safety devices (light curtain plus its interface – meaning the response time including the mechanical relay outputs) (in s).
Dpf depth penetration factor, or maximum travel towards the hazard within the FF-SCAN modular light curtain field that may occur before a stop is signaled (in in).

**⚠ WARNING**
**IMPROPER SAFETY DISTANCE**
- Calculate safety distance using formula Ds = K (Ts + Tc + Tr) + Dpf.
- Ds is the minimum safety distance from the light curtain sensing field to the danger zone (OSHA 29 CFR 1910.217 (c) (3) (iii) (e) and ANSI B11.1, B11.2, B11.19 and R15.06).
- The depth penetration factor Dpf is determined by both the installation of the product as well as the product's resolution (Minimum object sensitivity).

**Failure to comply with these instructions could result in death or serious injury.**

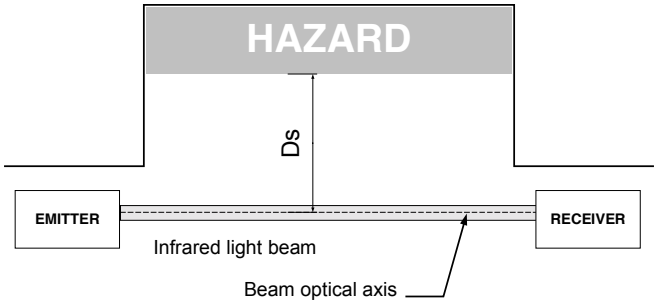


***Figure 3-3 Light curtain safety distance diagram***

### 3.3.1 Light curtain's resolutions

The FF-SCAN Series modular light curtain minimum object sensitivity Os is defined as follows :

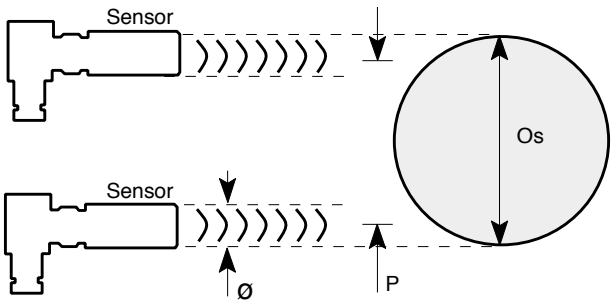


***Figure 3-4***

**Os = P + ø**

Where :
Os minimum object sensitivity
P maximum beam spacing
Ø FF-MPF18 sensors lens diameter (0.6 in).

### 3.3.2 Depth penetration factor for vertical sensing field

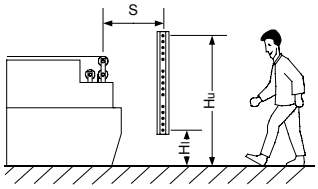


***Figure 3-5***

| | Reach thru | Reach over |
|---|---|---|
| If Os < 2.5 in then | Dpf = 3.4 (Os – 0.275 in) | Dpf = 48 in |
| If 24 in ≥ Os ≥ 2.5 in then | Dpf = 36 in | Dpf = 48 in |
| Bottom beam Hl at | 12 in | 12 in |
| Top beam Hu at | 48 in | 36 in |

**⚠ WARNING**

**IMPROPER PROTECTIVE HEIGHT**

- For « Reach Thru » applications, the light curtain's protective field must be sufficiently great such that personnel cannot reach over or under the light curtain without being detected. Moreover, the light curtain object sensitivity cannot exceed 24 in.
- The protective height is determined by the installation, measuring from the reference floor to the top beam.
- A protective height of 48 in may be adequate to detect personnel reaching through the curtain light field. Reference ANSI R15.06 Annex B – supplemental information.
- The installation may require a protective height greater than 48 in to properly safeguard personnel due to their height or working position (standing or sitting) or work station position relative to variations in floor elevations (or work platforms or stairs).
- Before use, verify that the protective heights are adequate for their intended use of safeguarding personnel.

**Failure to comply with these instructions could result in death or serious injury.**



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### 3.3.3 Depth penetration factor for horizontal sensing field

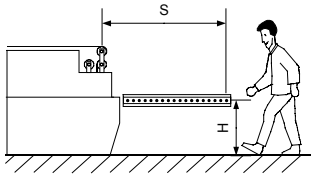


*Figure 3-6*

**Dpf = 48 in**

Allowable field heights H

| Object sensitivity Os | Mounting height | |
|---|---|---|
| | Min. (H = 15 (Os – 2 in)) | Max. |
| Os ≤ 2.0 in | 0.0 in | 39.0 in |
| 2.5 in ≤ Os < 3.0 in | 7.0 in | 39.0 in |
| 3.0 in ≤ Os < 3.5 in | 15.0 in | 39.0 in |
| 3.5 in ≤ Os < 4.0 in | 22.5 in | 39.0 in |
| 4.0 in ≤ Os < 4.6 in | 30.0 in | 39.0 in |
| Os ≥ 4.6 in | 39.0 in | 39.0 in |

**⚠ WARNING**

**IMPROPER MOUNTING HEIGHT**

- Mounting heights above 12 in may require supplemental safeguarding to prevent crawling or ducking under the horizontal field.
- Mounting height cannot exceed 39.0 in.

**Failure to comply with these instructions could result in death or serious injury.**

### 3.3.4 Depth penetration factor for angled sensing field

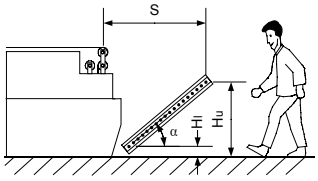


*Figure 3-7*

If angle $\alpha \geq 30°$, Dpf is as for vertical sensing field.
If angle $\alpha < 0°$, Dpf is as for horizontal sensing field.

## 3.4 Reflecting surfaces

The beam angle of optics and the alignment tolerance for emitter and receiver are approximately 2°. Since reflecting surfaces within the detection zone can lead to deflection and therefore non-detection of an obstacle, a minimum distance D to the optical axis should be observed. For a distance L between emitter and receiver, the following applies:

**D = 0,035 L/2 (mm) + 8 (mm)**

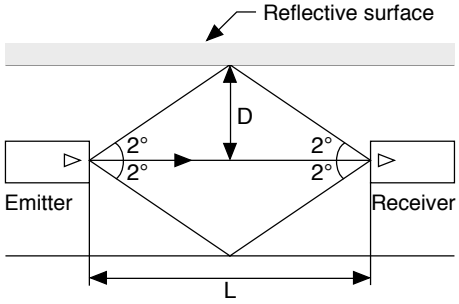


***Figure 3-8***

## 3.5 Range

Range = distance between emitter and receiver.
The maximum range of the FF-SCAN system is 25 m or 33 m **without any electronic tuning.**
The range can be modified, however during installation, the mechanical alignment tolerance of the sensors needs to be taken into account.
The admissible tolerance for mounting must take into account the opening angle of the beams.

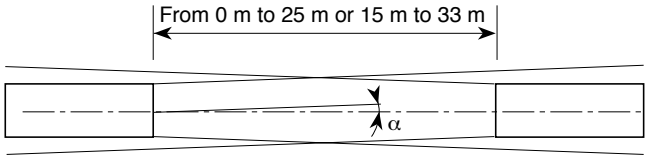


***Figure 3-9***

$\alpha$ = 2° angle
opening = ±2° angle

## 3.6 Mounting

### 3.6.1 Accessories for sensors

Honeywell offers optional mechanical accessories for the mounting of M18 sensors.

Basic bracket

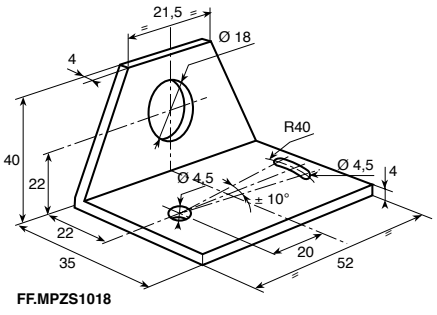


***Figure 3-10***

Mounting parallel to the optical axis
Adjustable, on site or on an arc

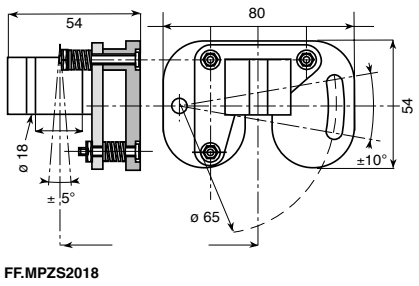


***Figure 3-11***



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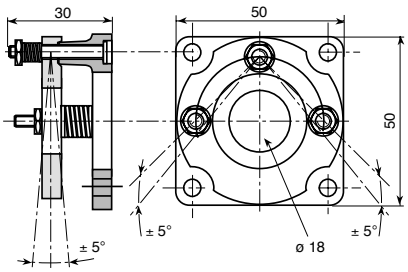
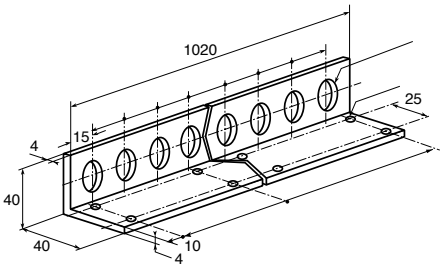
Mounting through walls/partitions
Adjustable on site or on azimuth




FF.MPZS3018

*Figure 3-12*

Fitting rail (1 meter)




FF-MPZS6018

*Figure 3-13*

**FF-SCZS1218**
**Multibeam safety column for access control:**

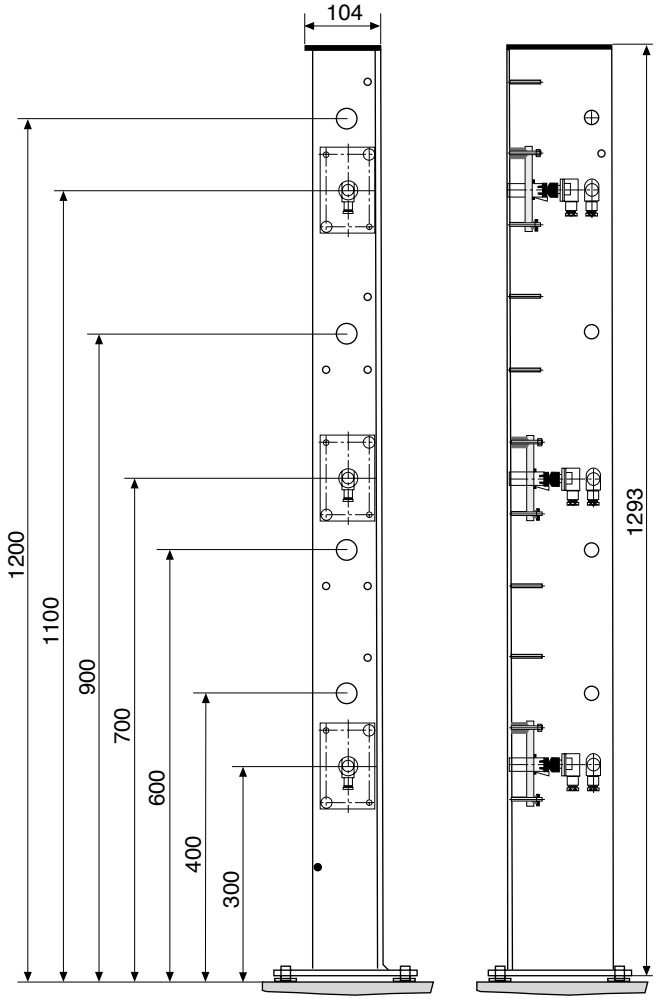



*Figure 3-14*

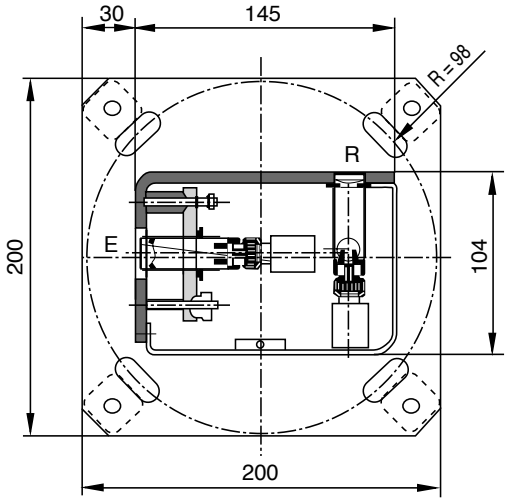



*Figure 3-15*

The FF-SCZS1218 safety column is a floor mounting column designed for FF-MPF sensors belonging to the FF-SCAN safety modular light curtain used in access control applications. When used with the appropriate deflection mirrors, protection perimeter can be easily built with 2, 3 or 4 beams in compliance with European norms. For perimetric protection on 4 sides, emitters and receivers can be mounted in the same column. Optical alignment is easy thanks to the column mechanics and the FF-MPZS4018 and FF-MPZS4032 adjustable mounting brackets which are exclusively designed for FF-MPFE… emitters. It is highly recommended to use the FF-SCZSE18R sensor when deflection mirrors are involved in the perimetric protection.

**Notes:** European norm (EN 999) specifies beam heights as follows:

| Number of beams | Heights (in mm) |
|---|---|
| 2 | 400, 900 |
| 3 | 300, 700, 1100 |
| 4 | 300, 600, 900, 1200 |

**FF-MPZS4018**
**Brackets for FF-MPF18 emitters (M18 sensors)**

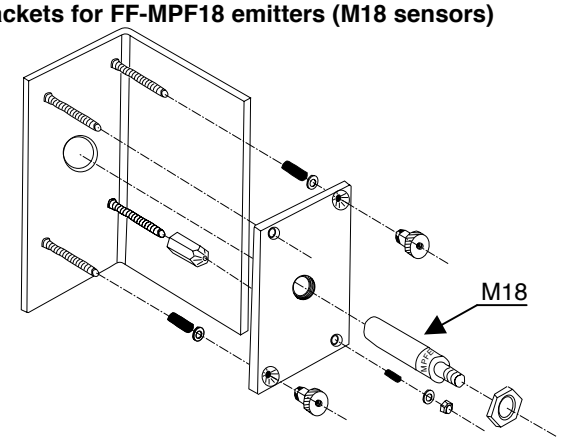



***Figure 3-16***

**FF-MPZS4032**
**Brackets for FF-MPFE32EX (M32 explosion proof sensors)**

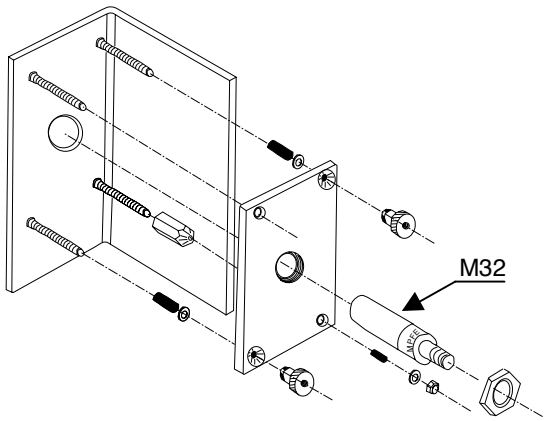



***Figure 3-17***

This bracket must be ordered separately to be able to install emitters on the FF-SCZS1218 column (order one bracket for each emitter). Refer to the installation manuals of the FF-SCZS1218 and FF-SCZ0…MIR accessories for more details on adjustments of sensors.

**FF-SCZSE18R**
**Visible red emission source**

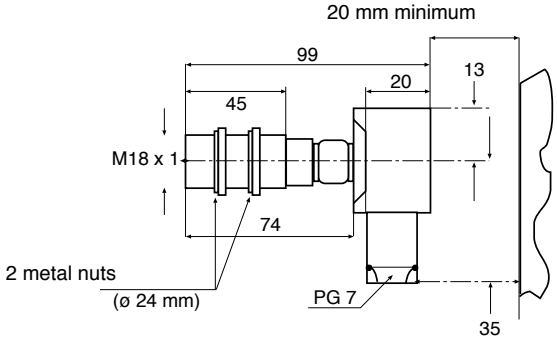



***Figure 3-18***

This sensor is a visible red emission source which is highly recommended to use when deflection mirrors are involved in a perimetric protection. This sensor must be connected to the FF-SC10 amplifier only and on the emitter side.



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**FF-SCZ0…MIR**
**Floor mounting deflection mirrors for perimetric protection**

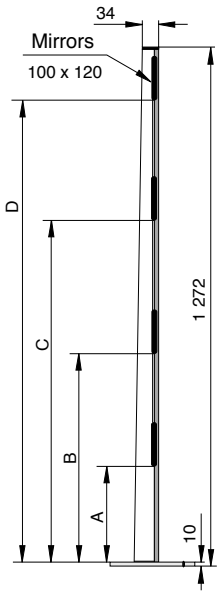


*Figure 3-19*

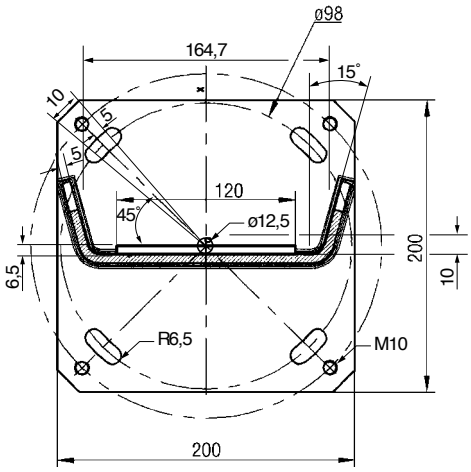


*Figure 3-20*

The FF-SCZ0…MIR floor mounting deflection mirrors are designed for perimetric protection when used with the European norms. Optical alignment is made easier thanks to mechanics which support the deflection mirrors, which are rigidly fixed to the column for a unique and common adjustment of the beams.

**Note:** European norm (EN 999) specifies beam heights as follows:

| Number of beams | Heights (in mm) | | | |
|---|---|---|---|---|
| | A | B | C | D |
| FF-SCZ02MIR (2 beams) | 400 | 900 | - | - |
| FF-SCZ03MIR (3 beams) | 300 | 700 | 1100 | - |
| FF-SCZ04MIR (4 beams) | 300 | 600 | 900 | 1200 |

## 3.6.2 Size

**FF-MPFE/R18 sensor mounted with connector**

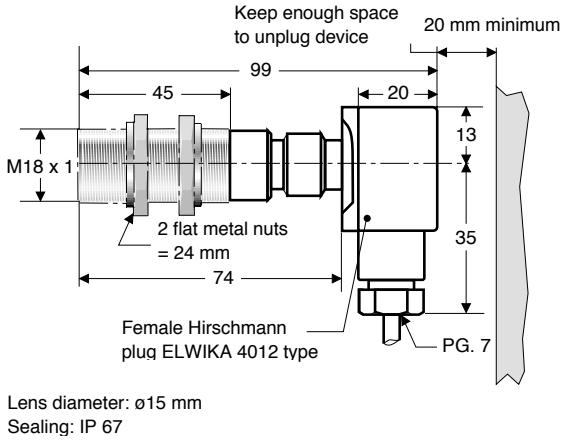


*Figure 3-21*

**Control unit FF-SC10 amplifier**

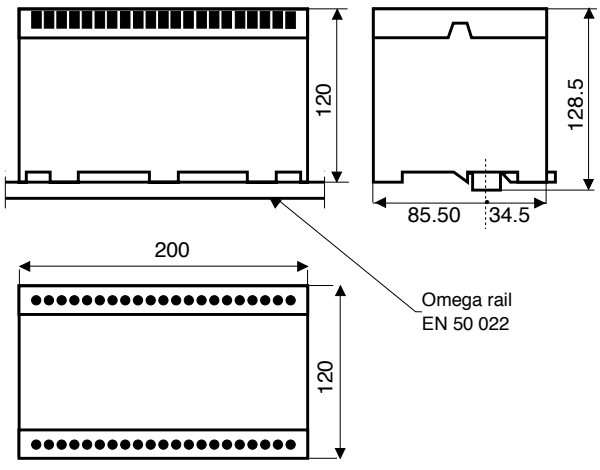


*Figure 3-22*

## *3.7 Connecting several FF-SCAN systems*

Several FF-SCAN systems can be connected together in order to increase the number of beams. However, in order to avoid mutual interferences, sensors should be installed as follow:

**In line connecting**

Care should be taken that there is no mutual optical interference on either system.

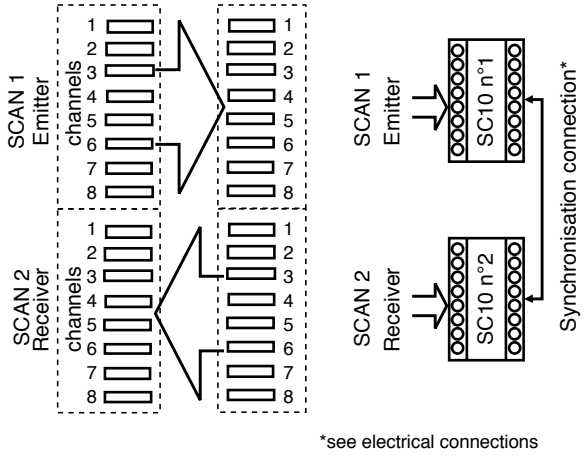


*Figure 3-23*

**L connecting**

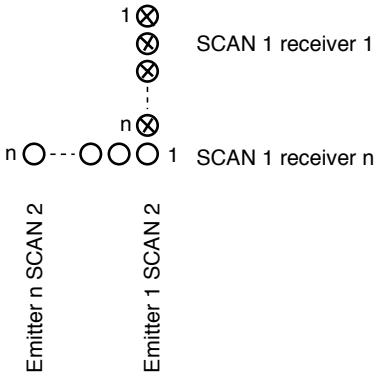


*Figure 3-24*

**Side by side connecting (principle)**

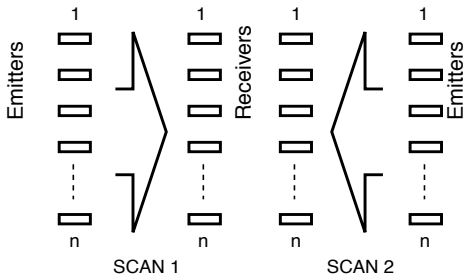


*Figure 3-25*



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# 4. Electrical connections

**Operating conditions**

After interconnection between the safety barrier and the machine operating circuit, the following safety functions must be checked:

- Any interruption of one or more beams of the photoelectric barrier, during a dangerous phase of the motion of the moving parts of the machine must immediately trigger the shutdown of the machine in phase with the response time of the moving elements.
- Clearing the protected field must not trigger the motion of the moving parts. It must then be necessary to start the machine manually, using the device designed to this effect.
- Switching on the electric power supply must not trigger the motion of any of the moving parts, especially after interruption within a cycle. To start the motion again, it is necessary to start the machine manually, using the device designed to this effect.
- The failure of part of the operating circuits must not generate risks. The complementary safety devices or any of the ones used for other functions of the machine must remain operational.

**Technical data**

- **FF-SC10 Control Unit**
  Two removable terminal strips with mechanical guides and safety screws (two 21 terminal strips, removable, error-proof). Electrical contacts meeting VBG4 and VDE0106-100 standards.
- **Sensors**
  Hirschmann ELST 412 4-pin male plug found on sensor. The corresponding female connector is available under reference FF-MPFCONN.
- **Supply voltage**

SCAN□18□-□

- E = 120 Vac
- G = 240 Vac

(+10 % / -20 %, 48 to 62 Hz, 20 VA)

- 4 = 24 to 48 Vdc (±15 %, 15 W)

## *4.1 FF-MPFE/R18 Sensor electrical interface*

**Connections**
1 ⟶ +
2 ⟶ shielding
3 ⟶ -
4 ⟶ free

**Cable**
1 pair (2 x 0,22 or 2 x 0,38 $mm^2$) insulated + shielded
We recommend you to use our cable referenced FF-MP175090.

**FF-MPFCONN**
**Female connector back view**

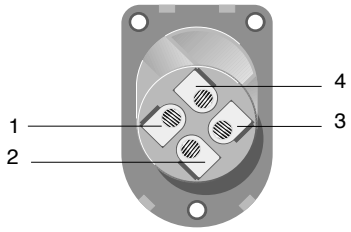
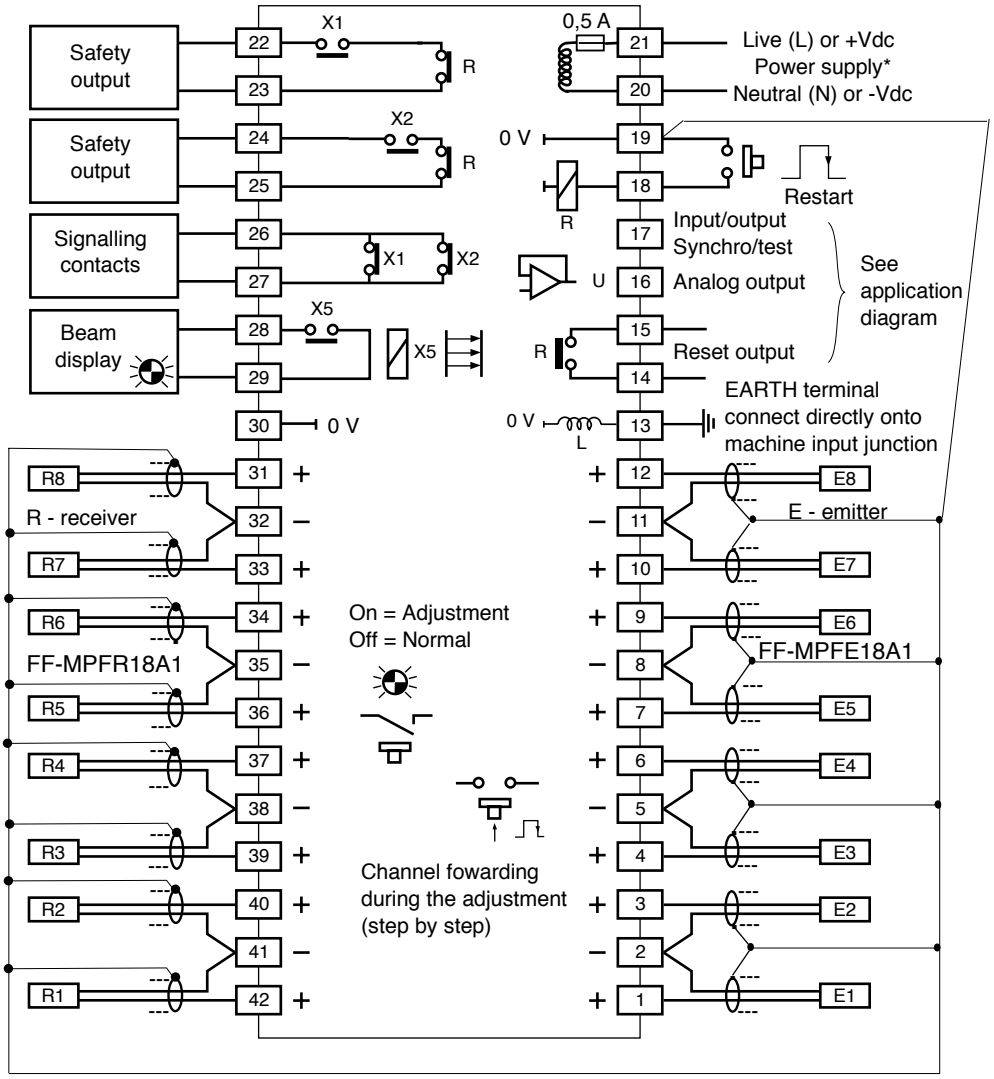



***Figure 4-1***

**Nota :**
1) Only the use of a good quality shielded cable maintains our warranty and safety conditions.
2) When high frequency servomotor or any other electromagnetic field source stands in the area, make sure the shielding of all the sensors is connected to the terminal 19 of the FF-SC10 control unit. The earth terminal 13 must be connected directly to the main earth input junction. Use a star quad twisting to isolate the protective equipment earth from the machine earth (refer to chapters 4.2 and 4.3). The ability of detecting a beam interruption must be checked every day for each beam, using the procedure mentioned in chapter 6.7.1.

## *4.2 FF-SC10 Amplifier's electrical interface*

Notice: other devices should not be connected to internally generated supply




* for Vdc versions, the FF-SC10 amplifier is protected against reversed polarity thanks to a rectifier.

***Figure 4-2***



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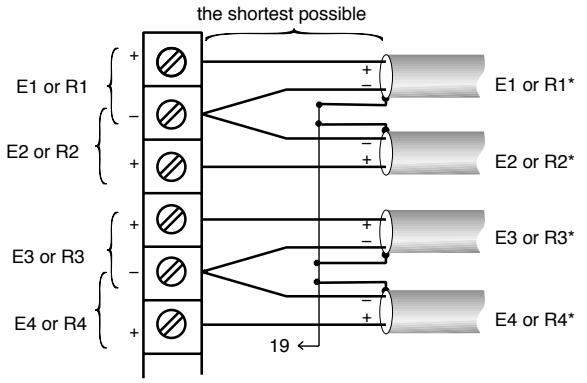
## *4.3 Electrical terminations*

### 4.3.1 Emitters and receivers

Maximum connection length between sensors and amplifiers: 50 m
**Electrical links**




Avoid proximity of parasite cables (min. distance 60 cm)
*All shields of receiver sensors have to be connected directly on terminal 19

***Figure 4-3***

Wiring through an additional terminal

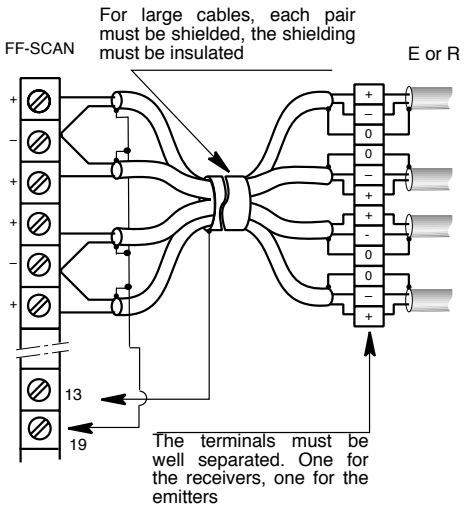
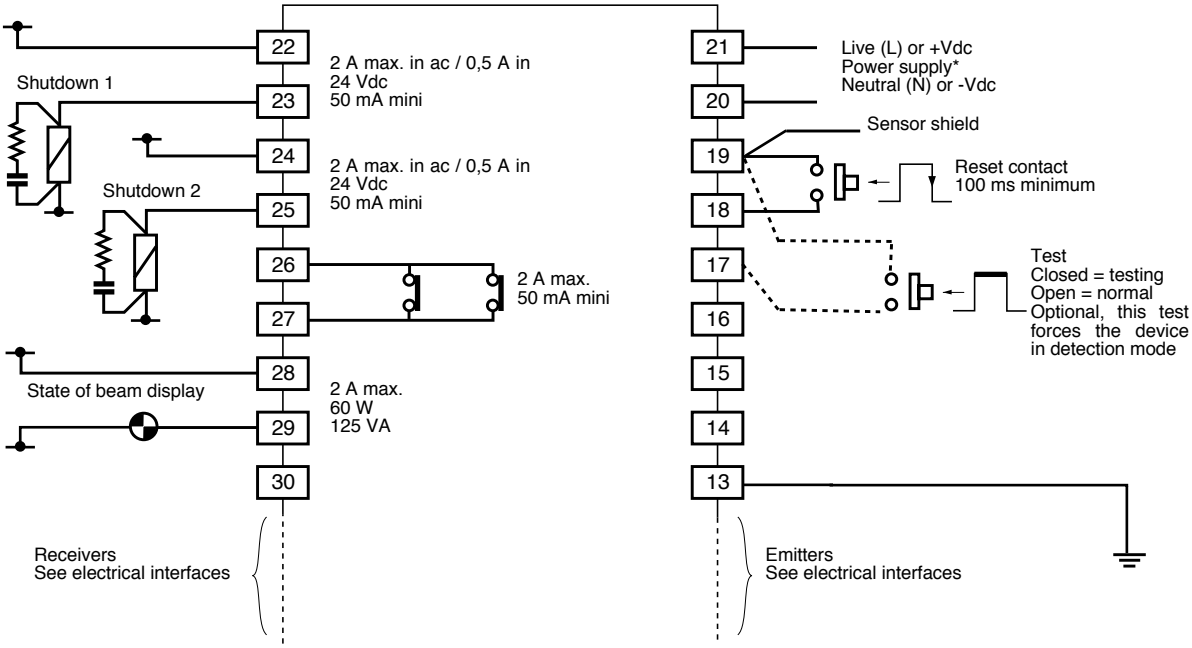



***Figure 4-4***

### 4.3.2 SC10 Amplifier

Application: electrical connection of one FF-SC10




*for Vdc versions, the FF-SC10 amplifier is protected against reversed polarity thanks to a rectifier.

***Figure 4-5***

**Notice 1:** 1 FF-SC10 Amplifier is delivered configured as follows:
• Manual restart. After each interruption of the infrared beam, restart is necessary.
• 8 operational beams (except in the case of SCAN system see chapter 5 and 8.1).
It is possible through internal programming to switch to automatic restart and/or to reduce the number of operational beams (down to 2) (see chapter 5.1).
However these operations should only be carried out with reference to the manual, and by skilled and trained personnel.

**Notice 2:** The available output 28/29 (beams free = closed contact) is display dedicated only.
It depends on the state of the beam without including the memory function.

**Notice 3:** In terminal 13 connect the main machine earth with the shortest possible core length. **The earth has to be clean.**

### 4.3.3 Applications

**Mounting in series of FF-SC10 amplifiers**

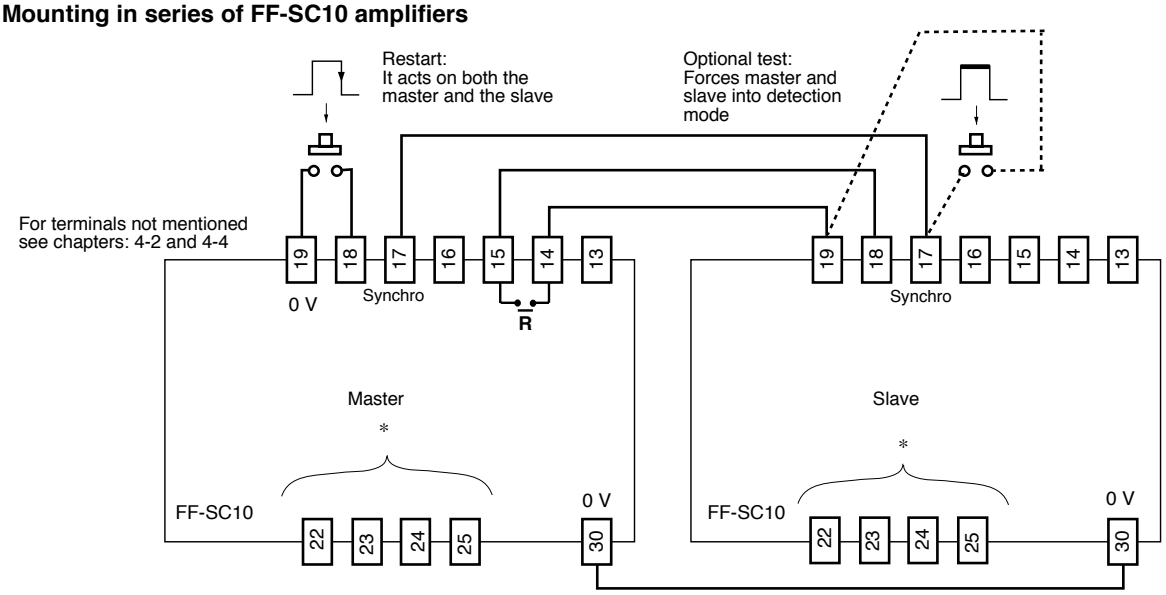
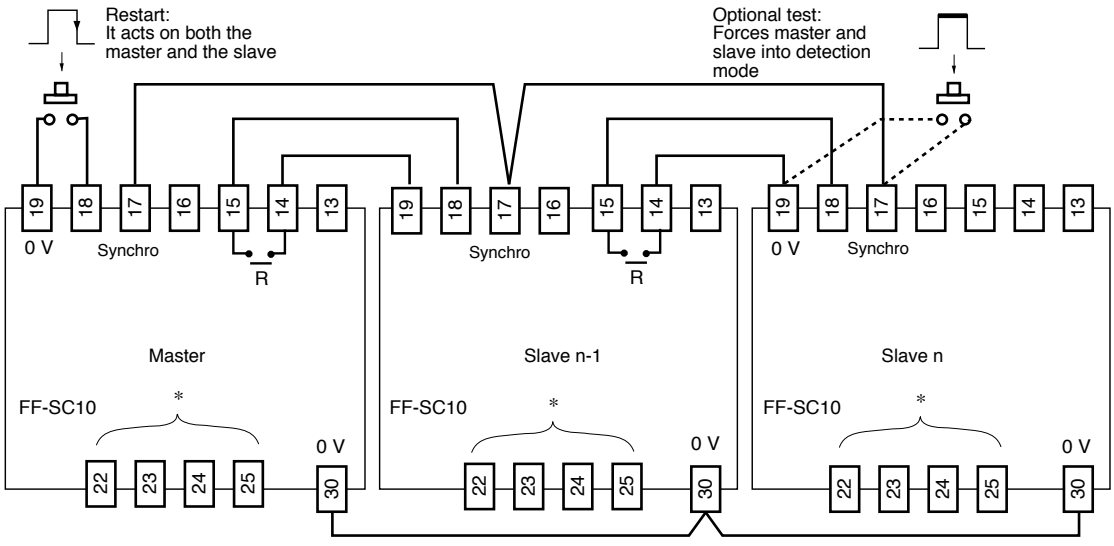



*Figure 4-6*

**Wiring of interconnections between amplifiers**




*All outputs should be connected in series to control the machine (see chapter 4-4)

*Figure 4-7*

**Note:**

1) Interconnection between several FF-SC10 amplifiers do not mean optical synchronisation between amplifiers (refer to chapter 3.7)
2) For terminals not mentioned, see chapters 4.2 and 4.4.



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## *4.4 Machine shutdown control*

Relays X1 + X2 operate simultaneously. They are internally cross monitored. If one of the two contacts of X1 or X2 remains closed for any reason, the remaining contacts will not be able to operate and will thus prevent the machine from running.

### 4.4.1 Protection for relay contacts

During switchover, the inductive loads (relays, electrovalves) generate considerable overvoltage which can shorten the relay's life span. This is why the use of RC circuits is highly recommended (electrical noise suppression). The connection of RC components will solve the problem and will comply with the guarantee clauses of the product.

**⚠ WARNING**

**IMPROPER CONNECTION OF ARC SUPPRESSORS**

The arc suppressors (RC circuits, for example 220 Ohms, 0,22 micro farads) must be connected in parallel to the inductive loads. Do not connect arc suppressors in parallel on the output relay contacts.

**Failure to comply with these instructions could result in death or serious injury.**

### 4.4.2 Machine with double stopping circuitry

In this case, use the contacts 22 and 23 & 24 and 25 separately:

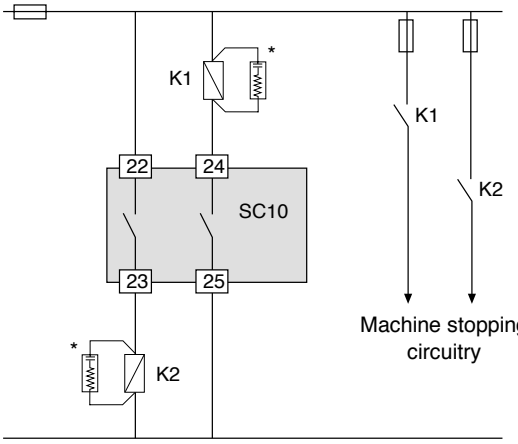


*Figure 4-8*

* RC component delivered with the unit: 220 Ω + 0,22 µF (see chapter 4.4.5 for correct interfacing of K1 and K2, the partial example here being more appropriate for ac power).

### 4.4.3 Connection of two FF-SC10 amplifiers

4 relays K1, K2, K3 and K4 would be used in the following manner:

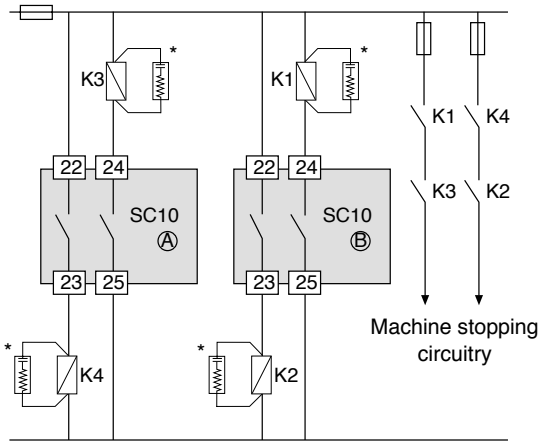


*Figure 4-9*

* RC component delivered with the unit: 220 Ω + 0,22 µF (see chapter 4.4.5 for correct interfacing of K1 and K2, the partial example here being more appropriate for ac power).

### 4.4.4 Examples of electrical interfaces involving additional relaying (I > 0,5 A dc or > 2 A ac)

**Example 1:**

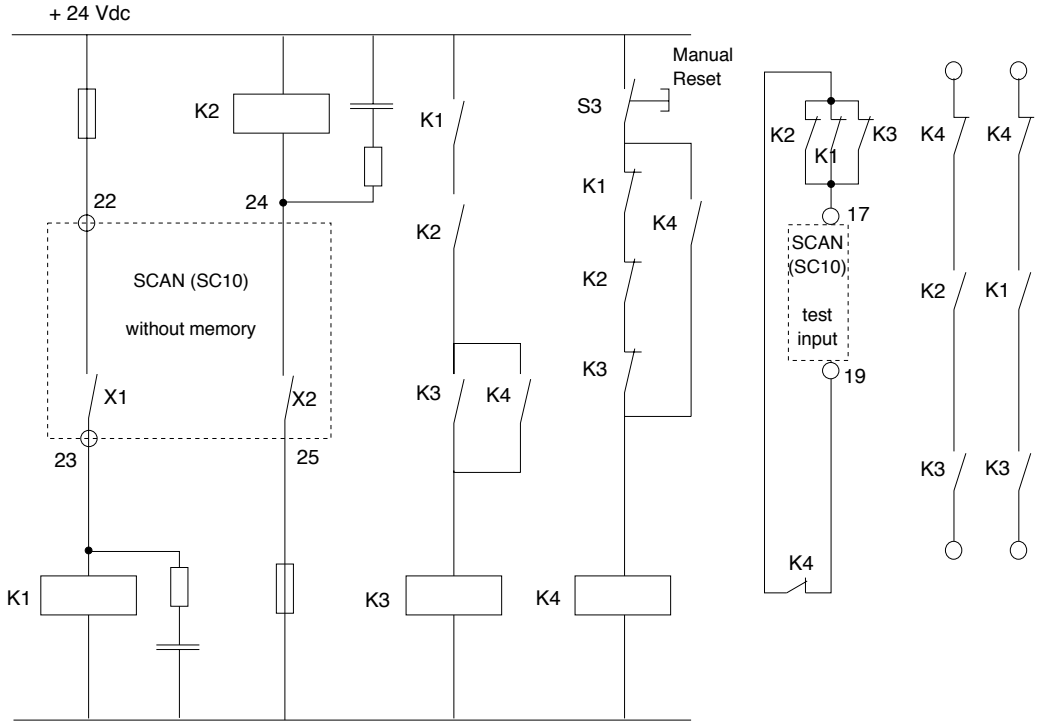


***Figure 4-10***

K1, K2, K3 and K4 are safety relays with guided contacts.

**Example 2:**

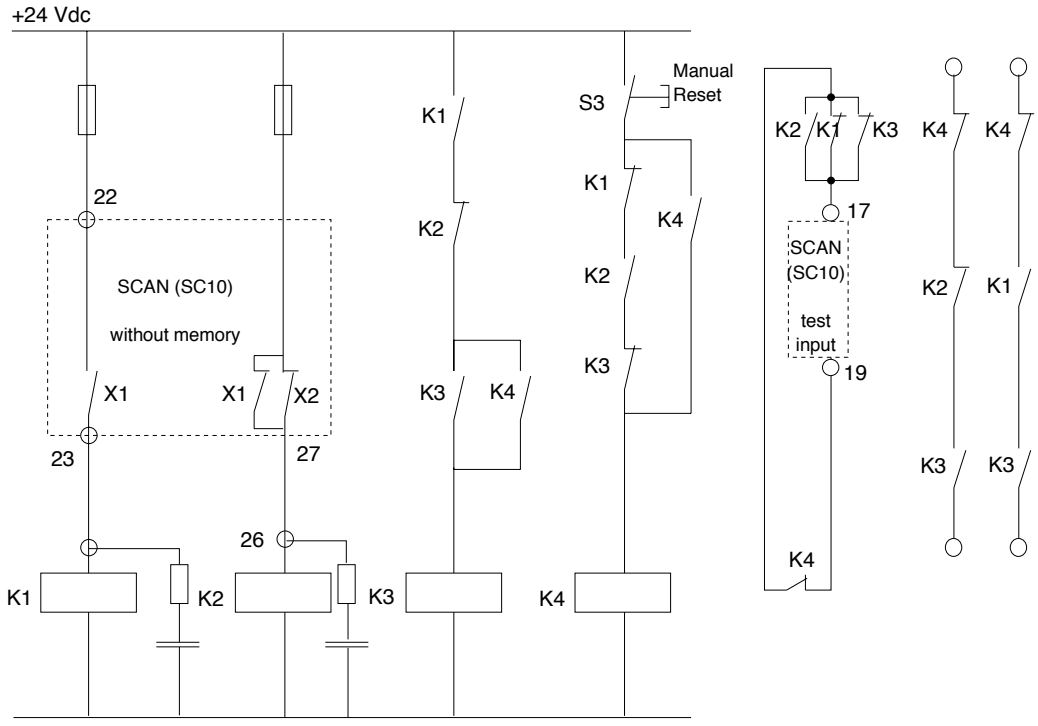


***Figure 4-11***

K1, K2, K3 and K4 are safety relays with guided contacts.



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### 4.4.5 Use of signalling contacts

**Do not use those contacts for machine shutdown.**

The normally closed (NC) contacts available on 26 and 27 are complementary to the utilisation outputs (22, 23, 24, 25). They are the NC contacts of the x1 and x2 output relays. In parallel, they allow redundant control of the shutdown data or allow the operation of a display function.

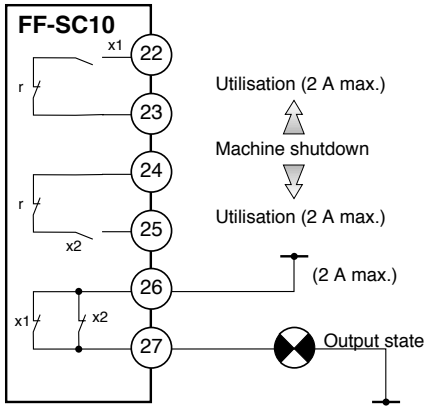


*Figure 4-13*

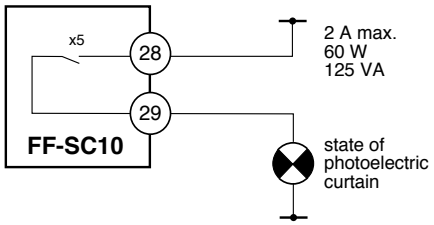


*Figure 4-12*

The available contact on 28 and 29 is normally open. Its switching is dedicated to the state of the safety curtain; if it is free, the contact is closed, if one or more of the beams are obstructed, the contact is open, it is independent of the latched function. This contact provides data on the status of the safety curtain.

## *4.5 Detection memory*

**Reset**

The utilisation outputs available on 22, 23, 24 and 25 are memorized, thus when the beams are freed, the contacts remain open. To close them, restart the system. Restarting consists of closing a momentary contact (100 ms minimum) between terminals 18 and 19.

**Notice:**

- It is possible to cancel the detection memory by altering the systems internal configuration.
- Inputs 18 and 19 are not free of potential. The terminals are used to control a relay R.
- A permanent short-circuit between terminals 18 and 19 will leave output contacts open.

## *4.6 Input test*

This function is optional. The closing of a contact between terminals 17 and 19 triggers the system's detection mode whatever the state of the safety curtain is (free or interrupted). This function can be used to check regularly and automatically that the machine's shutdown device switches itself off.

This test consists of regularly shortcircuiting the terminals 17 and 19 using an external contact and checking simultaneously that the shutdown device has functionned.

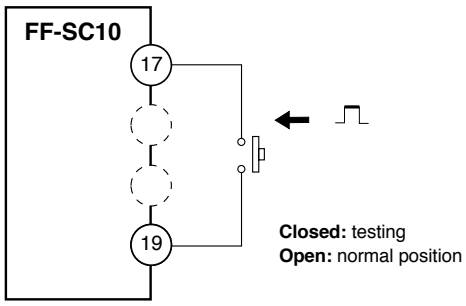


*Figure 4-14*

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# 5. Device configuration

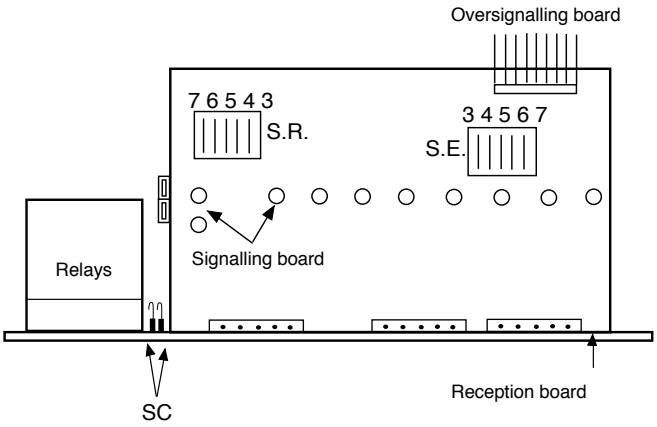
As explained in the previous paragraphs, the FF-SC10 amplifier allows varied work configurations, on both the number of infrared beams to operate, as well as the output mode (latched or non-latched detection).
The scan systems are sold with the requested configuration, in terms of the number of channels. For example a SCAN 3 will be supplied with a 3-channel configuration (thus able to operate 3 emitters and 3 receivers), a SCAN 5 will have a 5-channel configuration.
**N.B.:** A system which has been preconfigured with 5 channels will no longer be operational with 3 or 4 emitters/receivers. The SCAN 5 will only work with 5 beams unless it is re-configured as indicated below.
An other configuration element is the output mode. The modes can be selected.

- **Non-latched**, the utilisation output 22, 23, 24 and 25 follow the state of the safety curtain in real time. Partly or completely interrupted, the outputs are open. When the curtain is freed the output relays are triggered, thus allowing the machine to function again.
- **With memory**, the utilisation outputs follow the state of the safety curtain when interrupted. However, when the curtain is freed, the output relays remain open (switched off). A restarting procedure will then have to be carried out in order to start the machine again.

## *5.1 Changing the number of beams and the output memory*

– Unscrew the 4 screws located in the 4 corners of the FF-SC10 housing.
– Disconnect the connection terminals.
– Remove the front panel, using the 2 clips found on each side of the panel.
– Configure the system using the electrical microswitches (see channel number + output mode configuration).
– Replace the connection terminals.

### 5.1.1 Locating the configuration devices




SE + SR channel conficuration
SC detection memory configuration
Configuration microswitch

***Figure 5-1***

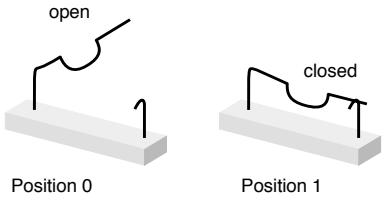
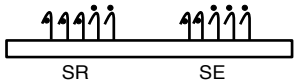



***Figure 5-2***

### 5.1.2 Channel configuration

Act on switches SE + SR
Example: 5 channel configuration




| Number of channels | Number of beams used | SR<br>7 6 5 4 3 | SE<br>3 4 5 6 7 |
|---|---|---|---|
| 3 | 1 to 3 | 1 1 1 1 1 | 0 0 0 0 0 |
| 4 | 1 to 4 | 1 1 1 1 0 | 1 0 0 0 0 |
| 5 | 1 to 5 | 1 1 1 0 0 | 1 1 0 0 0 |
| 6 | 1 to 6 | 1 1 0 0 0 | 1 1 1 0 0 |
| 7 | 1 to 7 | 1 0 0 0 0 | 1 1 1 1 0 |
| 8 | 1 to 8 | 0 0 0 0 0 | 1 1 1 1 1 |

**NOTICE**
The 2-channel programming can only be done in our factory and cannot be modified by the customer.

### 5.1.3 Detection memory configuration

Non-latched: SC in position "1".
Latched: SC in position "0".

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# 6. Setting up the system

## 6.1 Light indicators located on the front panel of FF-SC10 Amplifier

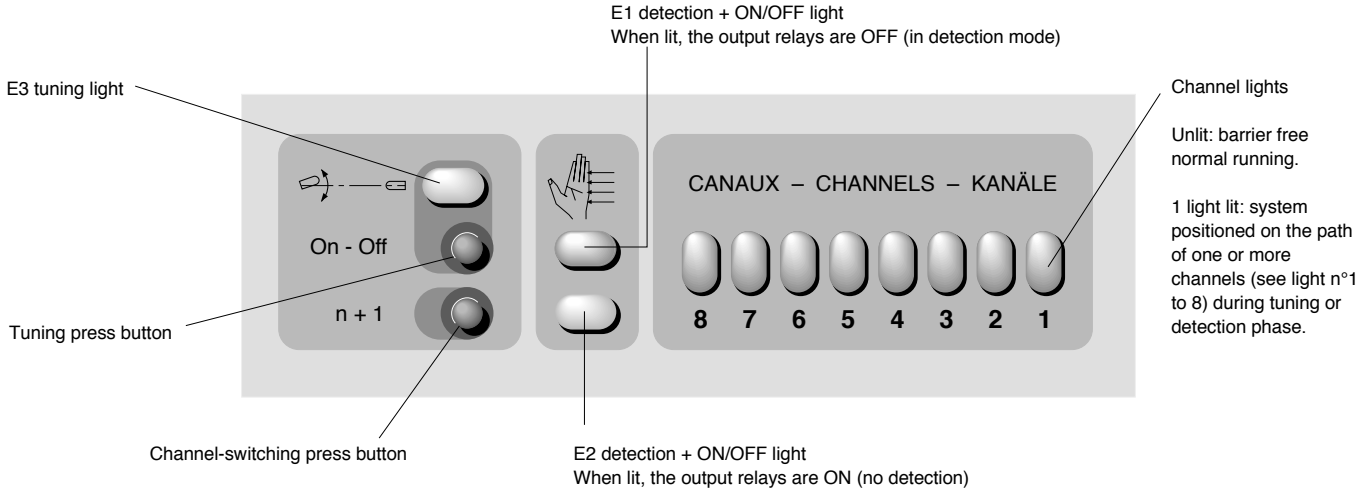


***Figure 6-1***

## 6.2 Mechanical adjustment of infrared beams

A setting up aid is integral to the device. A voltmeter analogue or digital set on a scale of 0 - 20 Vdc is necessary. A set of extended leads are also necessary, when the amplifier is remote.

## 6.3 Switching on

After carrying out the necessary electrical connections, check, before switching on, that voltage corresponds to the one indicated on the description plate. Power supply tolerances are the following:

120 Vac, +10 % / -20 %
240 Vac, +10 % / -20 %
24 to 48 Vdc, ±15 %

## 6.4 Alignment of sensors

**Adjustment operations** (start-up).
Mark the positions of the beams (for example from 1 to 8).
Check that power supply connected to 20 and 21 corresponds to the one indicated on the description plate.

Switch on. One of the lights E1 or E2 must be on.
Press on the ON/OFF button. E3 must light up.
One of the channel lights should be on (1 to 8), thus indicating which channel is valid. The available output contacts 22/23 and 24/25 are open.
Thus the machine can not run.
Press and release the n+1 button. The channel display increments one step per each operation of the button. Increment until indicator 1 is on (channel 1 is ready for adjustment).

Connect a voltmeter between terminals 16 and 19 of the FF-SC10's plug

**Note: when sensor alignment has been achieved there will be a voltage reading present on the voltmeter.**
Check the position of the first beam by breaking the beam nbr 1 (voltage should drop).
Tuning will consist in looking for the maximum voltage reading on the voltmeter.
**The absolute value should not be considered.** The purpose is to find the maximum on each beam.

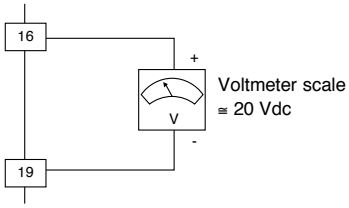


***Figure 6-2***

**E** Act mechanically on channel 1 emitter so as to reach a peak (max. value on the voltmeter).
**E** Mechanically lock the channel 1 emitter into position without making the voltage drop.
**R** Act mechanically the channel 1 receiver to improve the reading.
**R** Mechanically lock the channel 1 receiver into position without making the voltage drop.
**N** Press on n+1, then release. The indicator will move from channel 1 to channel 2. Channel 2 is then ready for adjustment.
Repeat the above sequence for channel 2 (see E + R).

Once this is achieved, increment to channel 3. Repeat the operation until you return to channel 1 then press the "ON-OFF".
Push button to switch on the normal mode: indicator E3 (must be off) (Indicator 1 is on).
Indicator E1 (red) must be on.
Indicator E2 (green) must be off.
The channel indicators should be off. If it is not the case, make sure that nothing is obstructing the safety curtain.
Make sure that the danger zone is free.
Restart by immediately closing a contact between terminals 18 and 19 of the FF-SC10 device (100 ms).
Light indicators E1 (red) switches itself off and E2 (green) switches itself on, displaying the output state.

**The system is then operational.**

## *6.5 Restart*

With SC microswitch on “1” (see chapter 5.1.3).
After each interruption of the infrared curtain the system must be restarted.
Re-start is achieved by closing a momentary contact connected between terminals 18 and 19 on the FF-SC10 amplifier.
**This contact must be momentary and must last more than 100 ms. Restart must be carried out only after making sure that the protected area is free. A restart procedure carried out while one or more beams are still interrupted will not produce any results.**

## *6.6 Final check*

It is important to check the geographical position of each sensor (emitter 1 must be facing sensor 1, etc) in order to avoid crossover such as the ones shown below.

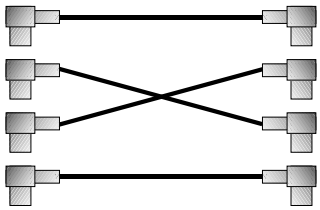


***Figure 6-3***

- **After starting-up, make sure that the interruptions of each beam triggers the shutdown of the machine.**
- **The removal cover should be in place and equipped correctly before power on the system. Any covers removed during setting up testing and inspection must be secured correctly in position before the system is operational.**


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## *6.7 Inspection and maintenance*

### 6.7.1 Inspection

| Check | Method | Frequency |
|---|---|---|
| Detection and machine stop | Insert an object corresponding to the diameter of the lens between the beams emitter and receiver.<br>Check that the machine stops. | Daily, at each power up |
| General operation of the FF-SCAN:<br>– Shutting down chain<br>– Response time | Test function generated by the machine (see chapter 4.6)<br>– Check MPCE operation<br>– Measure time between test and MPCE operation | Each time the machine is to be used or as part of each cycle |

### 6.7.2 Maintenance

| Check | Method | Frequency |
|---|---|---|
| Output relay replacement | By counting machine cycles.<br>Evaluation of the number of operations. | $10^5$ to $10^6$ operations or every 5 years if protective RC elements are mounted (see chapter 4.4.1) |
| Mechanical adjustment on infrared beams | See chapter 6.2 | Once a year |

**⚠ DANGER**

**IMPROPER RELAY OUTPUT BOARD MAINTENANCE**

After a period of extended operation, it is possible that a switching relay can malfunction such that it remains stuck or fused in the **closed** position folllowing a breach of the FF-SCAN protection field and the shutdown of the machine.

In the case of such a relay malfunction, the machine will not restart following the clearing of the protection field (and pressing of the restart button when in manual restart mode). It is essential to **immediately replace** the relays upon **the first occurrence** of a stuck or fused relay.

**Failure to comply with these instructions will result in death or serious injury.**

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# 7. System identification

### Description plate

Located on the side of each FF-SC10 amplifier, it indicates:

| | |
|---|---|
| **L** | scanning range (m) |
| **H** | protection height (mm) |
| **øR** | resolution (mm) |
| **øD** | lens diameter (mm) |
| **Type** | product listing |
| **V** | power supply voltage |
| **P** | power consumption |
| **F** | power supply frequency |
| ⎯/⎯ | **Imax/Vmax** max. switching capacity of the output relays |
| **N°** | serial number and date code (month and year) |
| **T** | response time (ms) |
| **IP/NEMA** | sealing (sensors/control unit) |

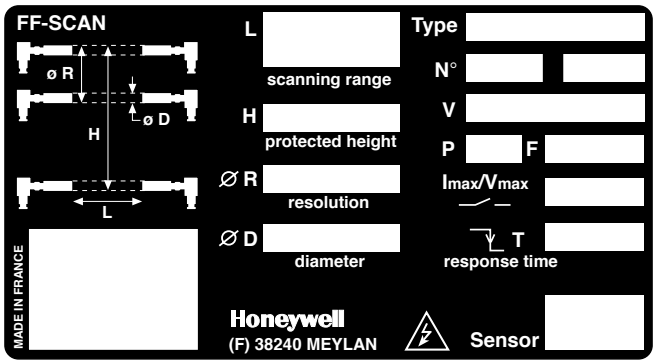


*Figure 7-1*

### Coding principle

FF-SC10M08☐

- E = 120 Vac, +10 % / -20 %
- G = 240 Vac, +10 % / -20 %
- 4 = 24 to 48 Vdc, ±15 %

### Approvals plate

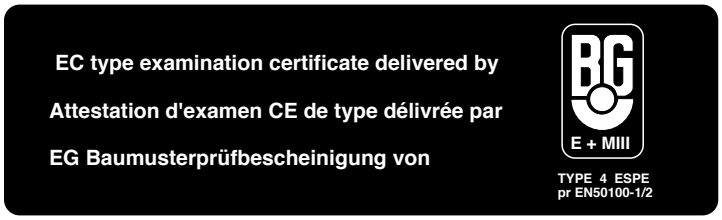


*Figure 7-2*

### Identification sticker

Each emitter and receiver carries a sticker with the following information:

- Name of manufacturer
- Reference
- Wiring

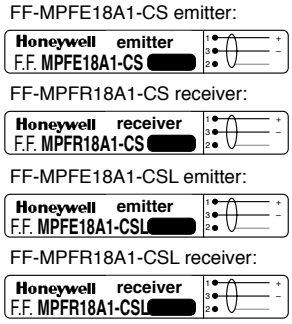


*Figure 7-3*

### Coding principle

FF-MPF☐18A1-CS☐

- E for emitter / R for receiver
- Threaded ø18 mm
- Max. operating range: blank: 0 m to 25 m; L: 15 m to 33 m

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# 8. References of available models and accessories

## *8.1 FF-SCAN systems*

The FF-SCAN systems are sets containing:
- The sensors (emitters and receivers, number depending on models)
- Female plugs (sufficient amount)
- Electrical wire (shielded)
- An FF-SC10 amplifier configured to suit the number of channels required.

Notice: The FF-SCANs are sold with detection memory function (see chapter 5.1.3).

* 2 to 4 channels, 100-meter roll
5 to 8 channels, 2 rolls of 100 m.

**References**

FF-SCAN☐18☐
- ☐ (first): Channel number (from 2 to 8)
- ☐ (second): Power supply
  - E = 120 Vac
  - G = 240 Vac
  - 4 = 24 to 48 Vdc

Example: FF-SCAN218E: 2 beams – 110 V

## *8.2 FF-SC10 amplifier*

Under this reference, it is the amplifier only.
Notice: the FF-SC10s are sold configured in 8 channels and with the detection memory function (see chapter 5.1.3).

**References**

FF-SC10M08☐
- ☐: Power supply
  - E = 120 Vac
  - G = 240 Vac
  - 4 = 24 to 48 Vdc

## *8.3 Sensors and accessories*

| | |
|---|---|
| FF-MPFE18A1-CS | Infrared emitter M18 (male plug), max. operating range = 0 m to 25 m |
| FF-MPFR18A1-CS | Infrared receiver M18 (male plug), max. operating range = 0 m to 25 m |
| FF-MPFE18A1-CSL | Infrared emitter M18 (male plug), max. operating range = 15 m to 33 m |
| FF-MPFR18A1-CSL | Infrared receiver M18 (male plug), max. operating range = 15 m to 33 m |
| FF-MPFE32EX-❑ | Infrared emitter M32, Ex-proof with 2 m, 3 m, 5 m or 10 m of cable, max. operating range = 15 m |
| FF-MPFR32EX-❑ | Infrared receiver M32, Ex-proof with 2 m, 3 m, 5 m or 10 m of cable, max. operating range = 15 m |
| FF-MPFCONN | Female 4-pin plug for sensor M18 |
| FF-MP175090 | Shielded 2-conductor wire (100 m. roll) |
| FF-MPZS1018 | Basic bracket |
| FF-MPZS2018 | Directional bracket |
| FF-MPZS3018 | Bracket (mounting through walls) |
| FF-MPZS6018 | 1-meter fitting rail - prebored at 18 mm |
| FF-SCZSE18R | Visible red emission source |
| FF-SCZS1218 | Multibeam safety column for access control |
| FF-MPZS4018 | Adjustable brackets for FF-SCZS1218 column and FF-MPFE18 emitters |
| FF-MPZS4032 | Adjustable brackets for FF-SCZS1218 column and FF-MPFE32EX (Ex-proof) emitters |
| FF-SCZ02MIR | Floor mounting deflection mirror for 2-beam access control |
| FF-SCZ03MIR | Floor mounting deflection mirror for 3-beam access control |
| FF-SCZ04MIR | Floor mounting deflection mirror for 4-beam access control |

## *8.4 Spare parts*

| | |
|---|---|
| FF-SCZ0110010 | 4 safety relays (2 output relays + 2 reset relays) |
| FF-SCZ192109-2 | 10 fuses 5 x 20 (0,5 A) for SCAN…18E or G |
| FF-SCZ192109 | 10 fuses (1 A) for SCAN…184 |

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# 9. CE Declaration of Conformity

**Honeywell**
**Sensing & Control**
B.P.81
38243 Meylan Cedex - France
Phone: (33) 4 76 41 72 00
Fax: (33) 4 76 41 72 56

## HONEYWELL
## QUALITY ASSURANCE DEPARTMENT

### CE declaration of conformity

We: Honeywell Sensing and Control
ZIRST B.P. 81
21, chemin du Vieux Chêne
38240 Meylan Cedex - France

Declare: under our sole responsibility that the Electrosensitive Protective Equipment catalogued:

***Modular Safety Light Curtains, FF-SCAN Series***

to which this declaration relates is in conformity with the technical requirements of the standards and the provisions of the essential requirements of the Directives detailed below.
We implement a quality insurance system in accordance with the ISO 9001 standard certified by the French organisation AFAQ under the number QUAL/1994/2213a.

Directives:
- **Machine Directive 98/37/EC** to which the EC-type examination certificate(1) delivered by the Berufsgenossenschaft E+MIII (BG) relates.
- **Low Voltage Directive 73/23/EC**
- **Electromagnetic Compatibility Directive 89/336/EC**

Standards: **pr EN 50100-part 1**(2)**:** Safety of Machinery - Electrosensitive Protective Equipment - General requirements for tests.
**pr EN 50100-part 2**(2)**:** Safety of Machinery - Electrosensitive Protective Equipment – Particular requirements for systems using active optoelectronic protective devices

Safety category: Type 4 as per pr EN 954

The conformity to the European directives of the type model from the series listed above has been certified by:

Notified body: BG-Prüfzert
Graf-Recke-Straße 69
40239 Düsseldorf - Germany

Certificate number: 99239 Date of certificate: 24/10/95

Legal Representative in Europe:
Place of issue: Meylan
Quality Manager:
Patrick Goud
Signature:

Date: 19/12/00
General Manager:
Richard Gibbs
Signature:

(1) : Available upon request.
(2) : The IEC is adopting the European project norm. Finally, it will be codified EN 61496- parts 1 & 2.

**Honeywell S.A.** – Capital 97 000 000 FRF
**Honeywell** – 21 Chemin du Vieux Chêne – Z.I.R.S.T. 38240 MEYLAN
SIREN 526 004 796 – APE 332B
Siège social : Honeywell Sensing and Control – Immeuble "Le Mercury"
Parc technologique de Saint-Aubin – Route de l'Orme – 91190 Saint Aubin
R.C.S. Corbeil-Essones B 562 004 796 – Phone : (33) 01 60 19 80 40 – Fax : (33) 01 60 19 81 73