



Safety Relay Modules  
HR6S



# Safety Relay Modules

Improve productivity with predictive maintenance  
of safety systems

IDEC CORPORATION

# Safety Relay Modules for IoT

The basis of a functional safety system is to use diagnosis to detect failures.

Redundant control systems, for example, maintain safety by detecting the occurrence of a single failure, and at the same time give user the opportunity to replace parts. This concept, which was introduced through international standards in 1999, has adopted throughout the world the idea of safety by control based on safety relay modules.

With the recent progress of IT technology, IoT is being promoted at factories around the world for the purpose of optimizing productivity. The optimal allocation of resources and predictive maintenance are important in such factories. However, predictive maintenance for safety systems that directly influence machine operation is especially important, and is indispensable for achieving both productivity and safety.

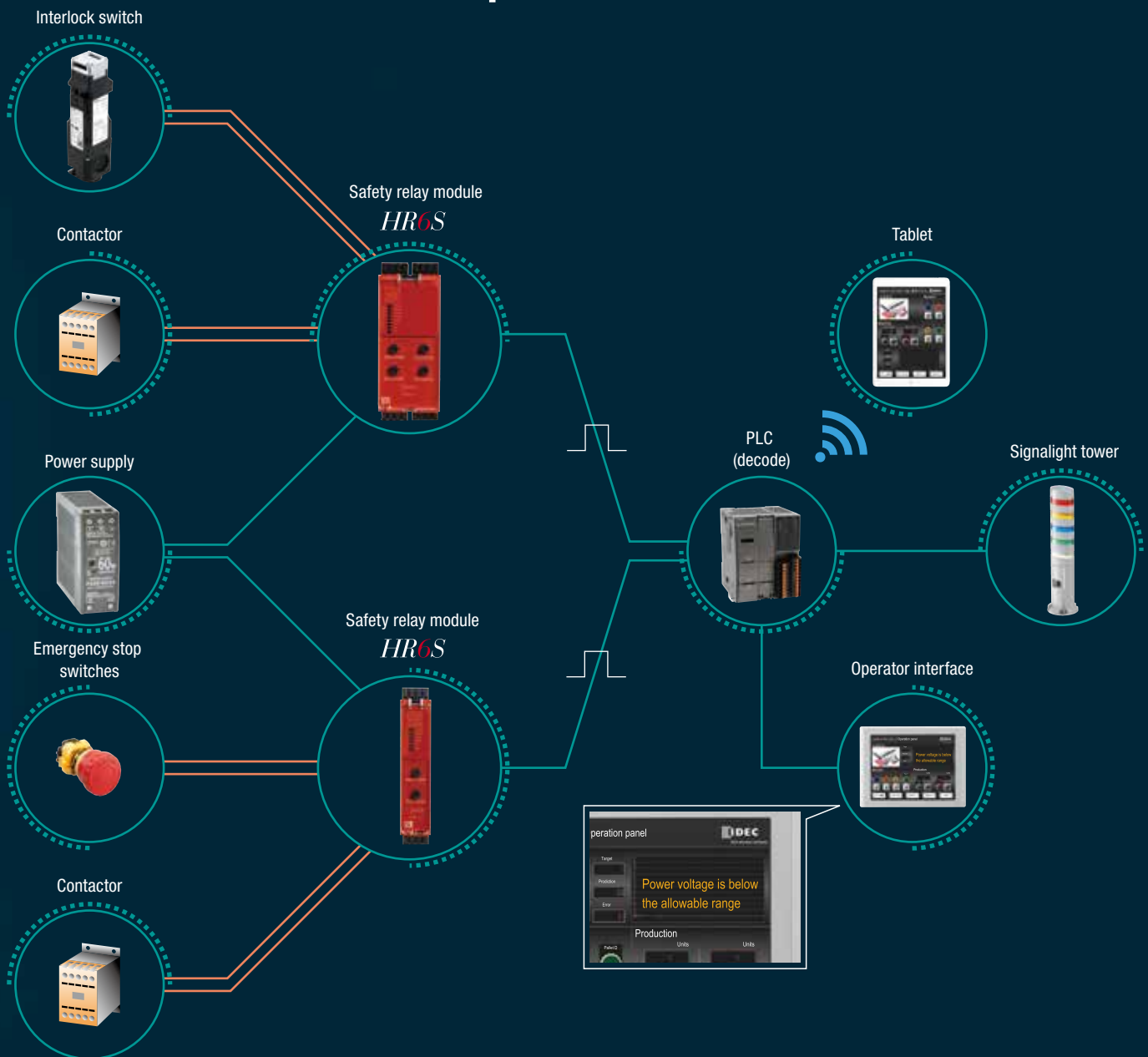
The HR6S safety relay module has advanced diagnostic functions, and can output the results. The diagnostic function, which is backed by international standards, monitors the safety relay module and the devices that are connected to it, and contributes to predictive maintenance for the safety system.



# Advanced Diagnostic and Output Functions

## Predictive Maintenance

Not only diagnostic results, but detailed information regarding safety-related parts such as input/output status can be acquired to prevent unintended stops. (For details, see page 28.)



# HR6S

SAFETY RELAY MODULE





## Connect to Various Input Devices

Dials are used to select input devices and start functions to enable safety measures for a wide variety of machines and allows standardization of the relay module.



### Setting a start function

Select from 8 types of start functions without changing the wiring. Automatic and manual operation can be selected as well as "startup test", which requires monitoring, cross-circuit detection, and pre-start inspection.

(For details, see page 28.)

### Setting an application function

Set up to 7 types of input devices, such as emergency stop switches, interlock switches, light curtains, RFID devices, magnet switches, proximity switches, two-hand control switches, and pressure-sensitive switches.



## Protection

A sealing strip to secure the protective cover is included, preventing the dials from inadvertent adjustment or settings from being changed.



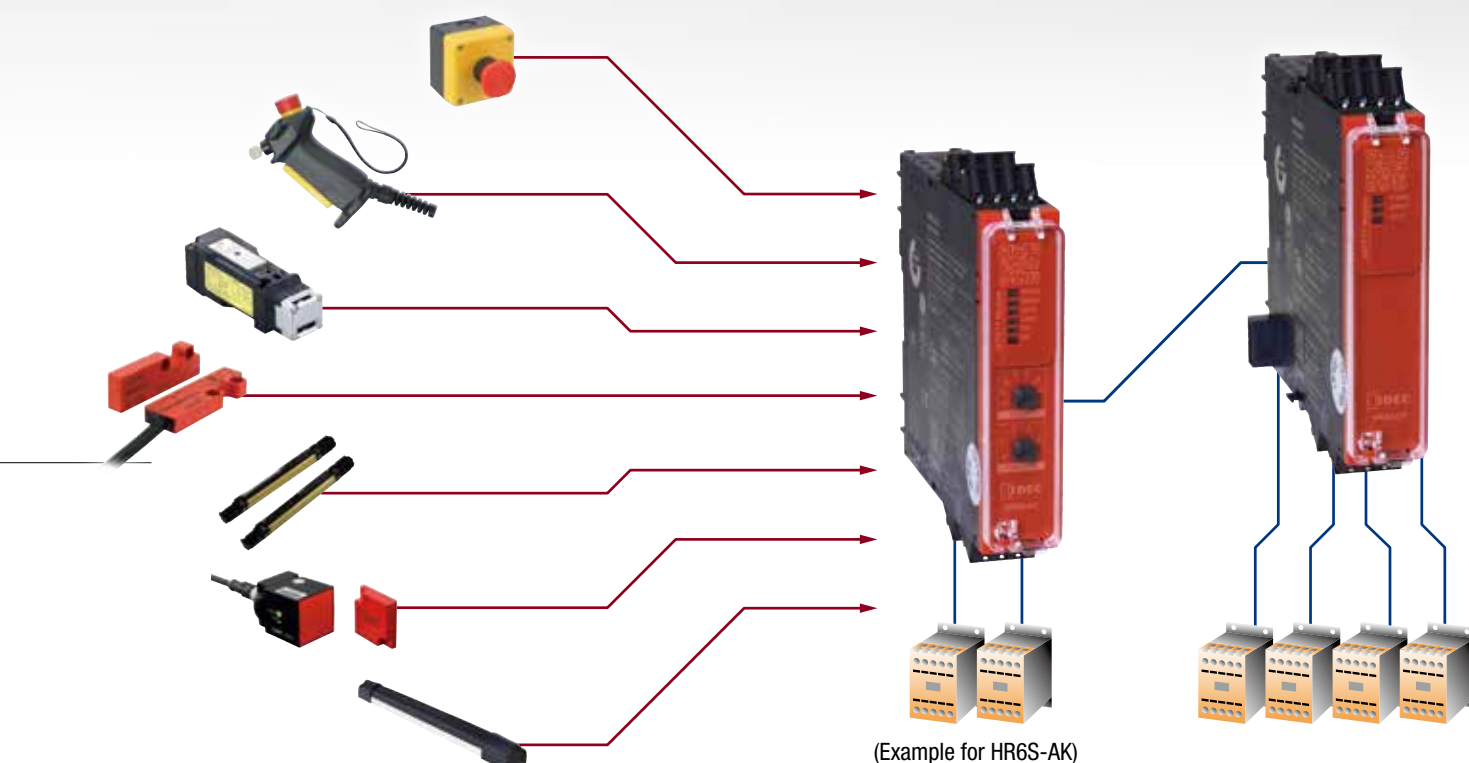
P R O T E C T I V E   C O V E R

## Output Expansion

Outputs can be expanded (excluding HR6S-AB).  
No wiring is required, because expansions are connected via the connector on the side of the unit.



O U T P U T   E X P A N S I O N



# LED Display for Viewing Status at a Glance

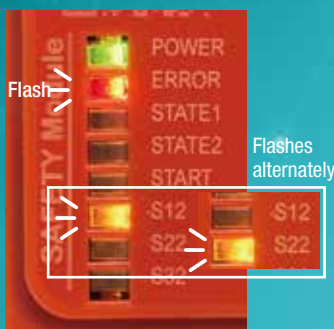
The LED indicators display approximately 20 different states by steady or flash light, or by combining. (For details, see page 28.)  
When an error occurs, its location is indicated, allowing maintenance to be performed immediately.

ERROR does not light on.



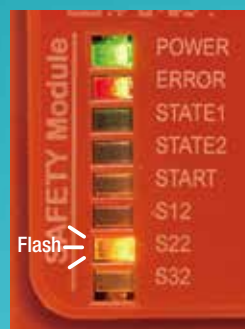
Indicates that safety-related input is activated.

ERROR flashes, and S12 and S22 flash alternately.



Indicates a safety input synchronization alert.

ERROR is steady, and either S12 or S22 flashes. If both flash, the flashing synchronizes.



Indicates a cross circuit in a safety input.

All LEDs light on.



Indicates that an inappropriate function mode has been set, or a setting has been changed after power on.

## Delay Function

By using the dials to set a combination of a coefficient from 0 to 0.9 and a magnification from 1x to 1000x, time limit can be set in the range of 0 to 900 seconds.

Also, the external input can be used to cancel the off-delay and immediately cut off the output. Expanded (\*1) output can be set to either instantaneous or delay.



\*1: Expansion output is set to instantaneous for 1 to 4, and to delay output for 5 to 8.

## Screw or Push-in Terminal Block

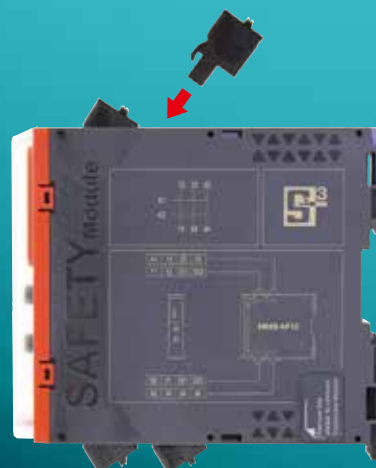
Choose from two types: a conventional screw terminal block or a highly-reliable push-in terminal block that saves wiring time. Both are removable and easy to maintain.



Push-in terminal



Screw terminal





|                                                                                                      |                                                                                     | Safety Relay Module                                                                                      |                                                                                                           |                                                                                                                                                        |                                                                                                                                                        |                                                                                                          |                                                                                                            | Expansion Module                                                                                            | Category 2 Safety Relay Module                                                                  |                                                                                                 |                                                                                                 |
|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
|                                                                                                      |                                                                                     | <br>HR6S-AB<br>(page 8) | <br>HR6S-AF<br>(page 10) | <br>HR6S-AK<br>(page 12)<br><small>Available in February 2021</small> | <br>HR6S-AT<br>(page 14)<br><small>Available in February 2021</small> | <br>HR6S-S<br>(page 17) | <br>HR6S-DN<br>(page 20) | <br>HR6S-EP<br>(page 23) | <br>HR5S-C2S | <br>HR5S-C2B | <br>HR5S-C2D |
| Maximum PL (*1)                                                                                      |                                                                                     | c                                                                                                        | e                                                                                                         | e                                                                                                                                                      | e                                                                                                                                                      | e                                                                                                        | e                                                                                                          | e                                                                                                           | c                                                                                               | d                                                                                               | d                                                                                               |
| Safety category (*1)                                                                                 |                                                                                     | 1                                                                                                        | 3, 4                                                                                                      | 3, 4                                                                                                                                                   | 3, 4                                                                                                                                                   | 3, 4                                                                                                     | 3, 4                                                                                                       | 3, 4                                                                                                        | 2                                                                                               | 2                                                                                               | 2                                                                                               |
| Delay (sec)                                                                                          |                                                                                     |                                                                                                          |                                                                                                           |                                                                                                                                                        | 0, 0.1, 0.2, 0.3 ... 900                                                                                                                               |                                                                                                          |                                                                                                            | 0, 0.1, 0.2, 0.3 ... 900                                                                                    |                                                                                                 |                                                                                                 | 0.25 to 4 (*5)                                                                                  |
| Input devices that can be connected (*2)                                                             |    | Emergency stop switch                                                                                    | √√                                                                                                        | √√                                                                                                                                                     | √                                                                                                                                                      | √√                                                                                                       | √                                                                                                          | √                                                                                                           | √                                                                                               | √                                                                                               | √                                                                                               |
|                                                                                                      |    | Electrical switch                                                                                        | √√                                                                                                        | √√                                                                                                                                                     | √                                                                                                                                                      | √√                                                                                                       | √                                                                                                          | √                                                                                                           | √                                                                                               | √                                                                                               | √                                                                                               |
|                                                                                                      |    | Coded magnetic switch (magnetic type)                                                                    | √√                                                                                                        | √√                                                                                                                                                     | √                                                                                                                                                      | √√                                                                                                       | √                                                                                                          | √                                                                                                           |                                                                                                 | √                                                                                               | √                                                                                               |
|                                                                                                      |    | Proximity sensor                                                                                         | √√                                                                                                        | √√                                                                                                                                                     | √                                                                                                                                                      | √√                                                                                                       | √                                                                                                          | √                                                                                                           |                                                                                                 |                                                                                                 |                                                                                                 |
|                                                                                                      |    | RFID sensor                                                                                              | √√                                                                                                        | √√                                                                                                                                                     | √                                                                                                                                                      | √√                                                                                                       | √                                                                                                          | √                                                                                                           |                                                                                                 |                                                                                                 |                                                                                                 |
|                                                                                                      |   | ESPE                                                                                                     | √√                                                                                                        | √√                                                                                                                                                     | √                                                                                                                                                      | √√                                                                                                       | √                                                                                                          | √                                                                                                           |                                                                                                 |                                                                                                 |                                                                                                 |
|                                                                                                      |  | Pressure-sensitive switch                                                                                |                                                                                                           |                                                                                                                                                        | √√                                                                                                                                                     | √√                                                                                                       |                                                                                                            |                                                                                                             |                                                                                                 |                                                                                                 |                                                                                                 |
|                                                                                                      |  | Two-hand control switch                                                                                  | √√<br>IIIA                                                                                                |                                                                                                                                                        |                                                                                                                                                        |                                                                                                          | √√<br>IIIA, IIIC                                                                                           |                                                                                                             |                                                                                                 |                                                                                                 |                                                                                                 |
| Parallel input for input device                                                                      |                                                                                     | 1 system                                                                                                 | 1 system                                                                                                  | 1 system                                                                                                                                               | 1 system                                                                                                                                               | 2 systems                                                                                                | 6 systems                                                                                                  | 1 system                                                                                                    | 1 system                                                                                        | 1 system                                                                                        | 1 system                                                                                        |
| Safety-related output                                                                                | Instantaneous                                                                       | 1C (SPDT)                                                                                                | 3NO                                                                                                       | 2NO-1NC                                                                                                                                                | 3NO                                                                                                                                                    | 2NO                                                                                                      | 3NO-1NC                                                                                                    | 4NO-2NC<br>(*3)                                                                                             | 2NO                                                                                             | 2NO                                                                                             | (*4)                                                                                            |
|                                                                                                      | Delay                                                                               |                                                                                                          |                                                                                                           |                                                                                                                                                        | 3NO-1NC                                                                                                                                                |                                                                                                          |                                                                                                            |                                                                                                             |                                                                                                 |                                                                                                 | 1NO                                                                                             |
| Output expansion  |                                                                                     |                                                                                                          | √                                                                                                         | √                                                                                                                                                      | √                                                                                                                                                      | √                                                                                                        | √                                                                                                          |                                                                                                             |                                                                                                 |                                                                                                 |                                                                                                 |
| Status output (Semiconductor)                                                                        | All diagnostic results (For details, see page 29.)                                  | √                                                                                                        | √                                                                                                         | √                                                                                                                                                      | √                                                                                                                                                      | √                                                                                                        | √                                                                                                          |                                                                                                             |                                                                                                 |                                                                                                 |                                                                                                 |
|                                                                                                      | Safety-related output monitor                                                       |                                                                                                          |                                                                                                           |                                                                                                                                                        | √                                                                                                                                                      |                                                                                                          |                                                                                                            |                                                                                                             |                                                                                                 |                                                                                                 |                                                                                                 |
|                                                                                                      | Failure detection output                                                            |                                                                                                          |                                                                                                           |                                                                                                                                                        |                                                                                                                                                        |                                                                                                          |                                                                                                            |                                                                                                             | √                                                                                               | √                                                                                               | √                                                                                               |
| Number of LEDs                                                                                       |                                                                                     | 6                                                                                                        | 6                                                                                                         | 6                                                                                                                                                      | 8                                                                                                                                                      | 8                                                                                                        | 16                                                                                                         | 3                                                                                                           | 2                                                                                               | 2                                                                                               | 3                                                                                               |

\*1: First, determine the PLr and category of the safety system.

\*1: NC contacts are compatible with category 1 and PLC.

\*2: Although both "√" and "√√" can be connected, models indicated with "√√" is recommended for use.

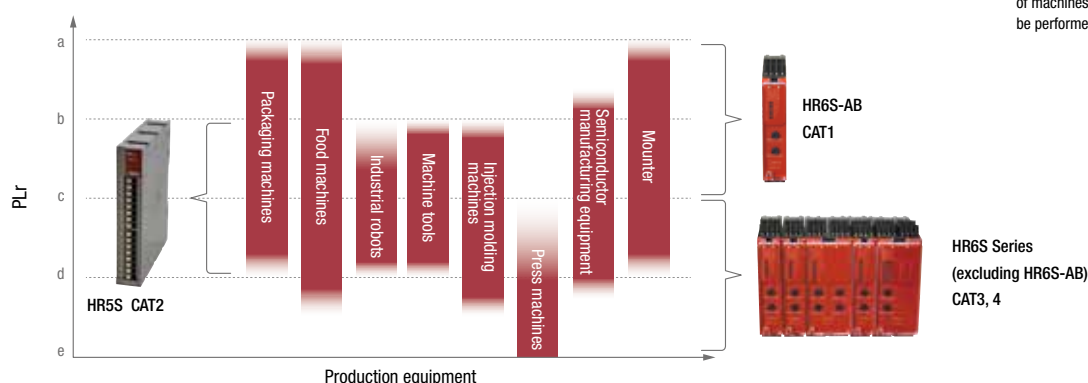
When inputting multiple input devices in parallel, select either HR6S-S or HR6S-DN.

\*3: When connecting to HR6S-AT, use the selector to select instantaneous or delay.

\*4: Non-safety-related instantaneous output available.

\*5: 5 types - 0.25 s, 0.5 s, 1 s, 2 s, and 4 s.

## Performance level of facilities and applicable models



- When defining the performance level of machines, a risk assessment must be performed for each machine.

# HR6S-AB Safety Relay Module

## PLc achieved with Category 1 configuration

- With a variety of common input devices, the HR6S-AB can monitor two-hand control devices (IIIA) that are required to comply with ISO 13851.
- Suitable for use as a self-holding circuit for selecting a wide variety of start functions for low-risk machines.
- Output cannot be expanded using expansion modules.

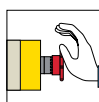
### HR6S-AB

Package Quantity: 1

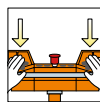
| Terminal         | Part No.  | Supply Voltage |
|------------------|-----------|----------------|
| Push-in terminal | HR6S-AB1C | 24V AC/DC      |
| Screw terminal   | HR6S-AB1P | 24V AC/DC      |

- One sealing strip (see page 26) is included with each product.

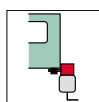
### Overview of Application Functions



Monitoring of Emergency Stop circuits as per ISO 13850 and IEC 60204-1, stop category 0



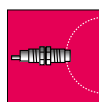
Monitoring of two-hand control devices, type III A as per ISO 13851



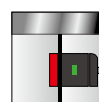
Monitoring of guards as per ISO 14119/14120 with interlock switches



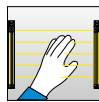
Monitoring of guards as per ISO 14119/14120 with coded magnetic switches



Monitoring of proximity switches



Monitoring of RFID sensors



Monitoring of electro-sensitive protective equipment such as type 4 light curtains as per IEC 61496-1



- See website for details on approvals and standards.

### Safety-Related Outputs

|                                                                                        |                                                          |
|----------------------------------------------------------------------------------------|----------------------------------------------------------|
| Number of relay contacts, changeover (Normally Closed to Normally Open), instantaneous | 1                                                        |
| Maximum short circuit current I <sub>K</sub>                                           | 1 kA                                                     |
| Maximum continuous current, Normally Open relay contacts                               | 3 A                                                      |
| Maximum continuous current, Normally Closed relay contacts                             | 3 A                                                      |
| Maximum total thermal current $\Sigma I_{THERM}$                                       | 3 A                                                      |
| Minimum current                                                                        | 10 mA                                                    |
| Utilization category as per UL 60947-5-1                                               | D300 and R300                                            |
| Utilization category as per IEC 60947-4-1 and IEC 60947-5-1                            | AC-1: 250 V<br>AC-15: 250 V<br>DC-1: 24 V<br>DC-13: 24 V |
| Maximum current, normally open relay contacts                                          | AC-1: 5 A<br>AC-15: 3 A<br>DC-1: 5 A<br>DC-13: 2 A       |
| Maximum current, normally closed relay contacts                                        | AC-1: 3 A<br>AC-15: 1 A<br>DC-1: 3 A<br>DC-13: 1 A       |
| External fusing                                                                        | 6 A, category gG                                         |

### Additional Non-Safety-Related Outputs

|                 |        |
|-----------------|--------|
| Output voltage  | 24V DC |
| Maximum current | 20 mA  |

### Synchronization Times

The synchronization times for the synchronization of safety-related inputs depend on the application function. (See page 9 Function Mode Selector and Input Device Connection Example.)

### Data Functional Safety

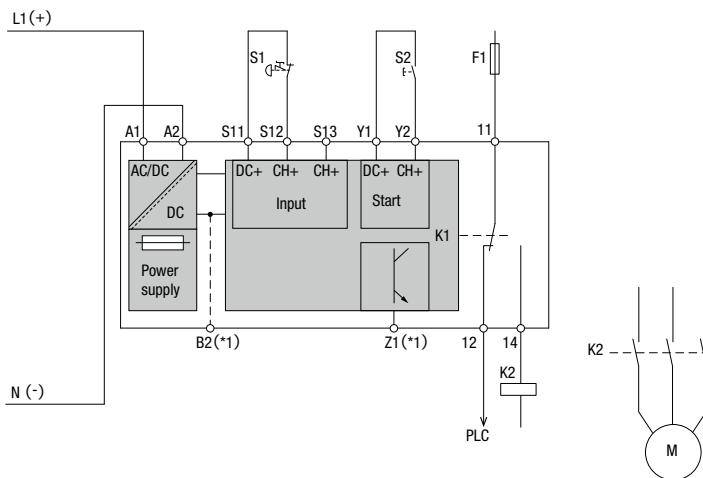
|                                                                                                         |                                                                                           |                    |
|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|--------------------|
| Defined safe state                                                                                      | Safety-related outputs are de-energized<br>Normally Open: open<br>Normally Closed: closed |                    |
| Maximum Performance Level (PL), Category (as per ISO 13849-1:2015)                                      | PLc, Category 1                                                                           |                    |
| Maximum Safety Integrity Level (SIL) (as per IEC 61508-1:2010)                                          | 1                                                                                         |                    |
| Safety Integrity Level Claim Limit (SILCL) (as per IEC 62061:2005+AMD1:2012 +AMD2:2015)                 | 1                                                                                         |                    |
| Type (as per IEC 61508-2)                                                                               | B                                                                                         |                    |
| Hardware Fault Tolerance (HFT) (as per IEC 61508 and IEC 62061)                                         | 0                                                                                         |                    |
| Stop Category for Emergency Stops (as per ISO 13850 and IEC 60204-1)                                    | 0                                                                                         |                    |
| Lifetime in years at an ambient temperature of 55 °C (131 °F)                                           | 20                                                                                        |                    |
| Safe Failure Fraction (SFF) (as per IEC 61508 and IEC 62061)                                            | >60 %                                                                                     |                    |
| Probability of Dangerous Failure per hour (PFH <sub>D</sub> ) in 1/h (as per IEC 61508 and ISO 13849-1) | 1175.6 x 10 <sup>-9</sup>                                                                 |                    |
| Mean Time To Dangerous Failure (MTTF <sub>D</sub> ) in years (as per ISO 13849-1)                       | 91                                                                                        |                    |
| Average Diagnostic Coverage (DC <sub>avg</sub> ) (none as per ISO 13849-1)                              | —                                                                                         |                    |
| Maximum number of cycles over lifetime                                                                  | DC-13                                                                                     | 24V DC 2 A: 50000  |
|                                                                                                         | AC-15                                                                                     | 250V AC 3 A: 50000 |

For other specifications (common to all models), see page 25.



## HR6S-AB

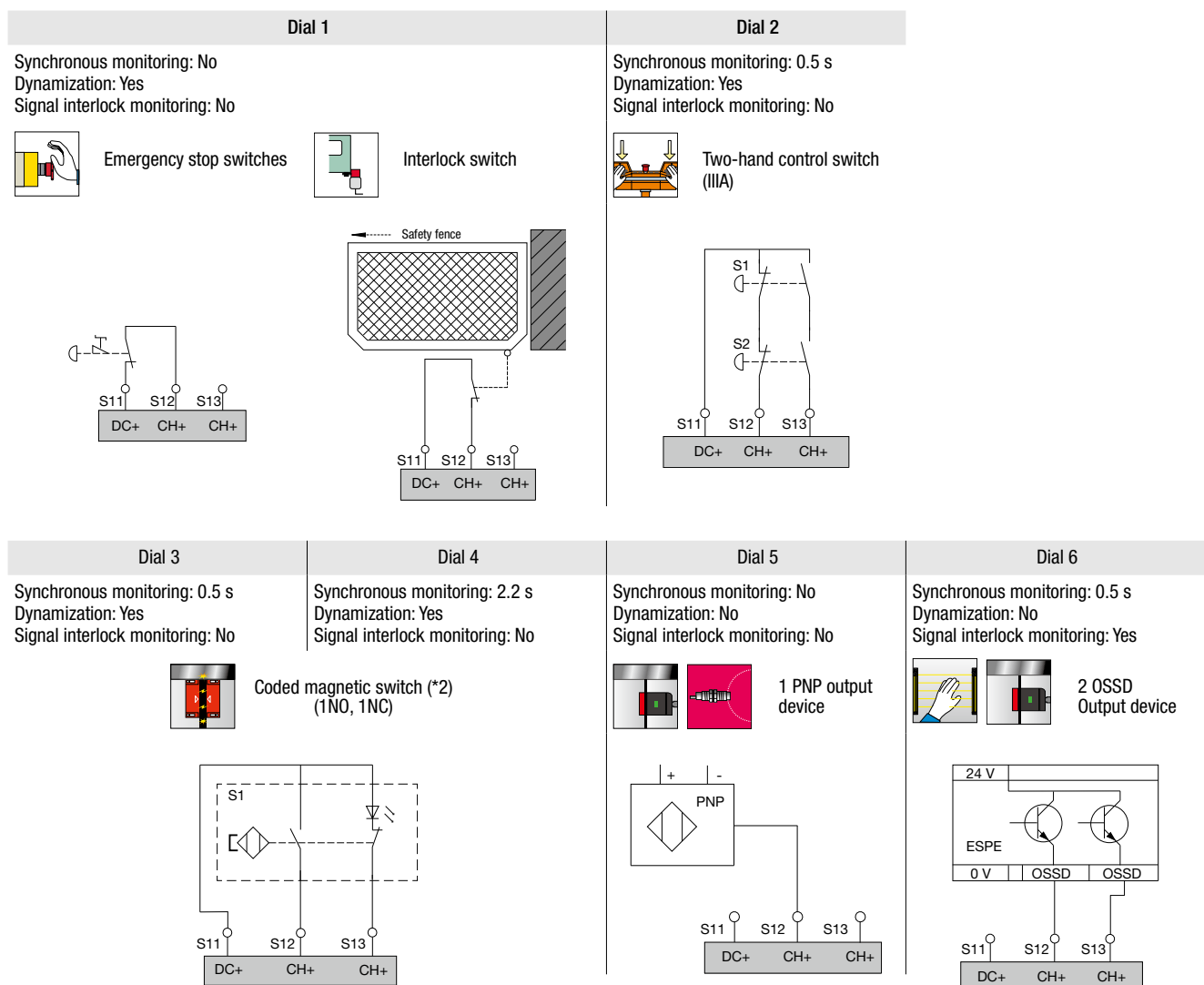
## Wiring



| Designation | Explanation                                       |
|-------------|---------------------------------------------------|
| B2          | Common reference potential terminal               |
| Z1          | Pulsed output for diagnostics, not safety-related |
| S1          | Emergency stop switch                             |
| S2          | Start switch                                      |
| K2          | Contactors                                        |
| M           | Motor                                             |
| F1          | Fuse                                              |

\*1) For B2 and Z1, see HR6S-AF.

## Function Mode Selector and Input Device Connection Example



\*2: Connection examples for coded magnetic switches such as HS7A (IDEC) are also included on the instruction sheet, but certifications are not available.

Note: Status of contacts in the diagram: The status of the control switch is when it is not operated. The status of the door interlock is when the door is closed.

# HR6S-AF Safety Relay Module

## Standard module for building safety systems

- Protects both the operator and the machine by immediately stopping dangerous movements when instructed to stop by the operator or when a failure in the safety circuit is detected.
- The most basic module for building a safety system.



- See website for details on approvals and standards.

### HR6S-AF

Package Quantity: 1

| Terminal         | Part No.  | Supply Voltage |
|------------------|-----------|----------------|
| Push-in terminal | HR6S-AF1C | 24V AC/DC      |
| Screw terminal   | HR6S-AF1P | 24V AC/DC      |

- One sealing strip (see page 26) is included with each product.



Output expansion possible

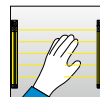
## Overview of Application Functions



Monitoring of Emergency Stop circuits as per ISO 13850 and IEC 60204-1, stop category 0



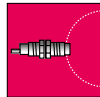
Monitoring of guards as per ISO 14119/14120 with coded magnetic switches



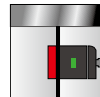
Monitoring of electro-sensitive protective equipment such as type 4 light curtains as per IEC 61496-1



Monitoring of guards as per ISO 14119/14120 with interlock switches



Monitoring of proximity switches



Monitoring of RFID sensors

## Safety-Related Outputs

|                                                             |                                                          |
|-------------------------------------------------------------|----------------------------------------------------------|
| Number of relay contacts, Normally Open, instantaneous      | 3                                                        |
| Maximum short circuit current I <sub>K</sub>                | 1 kA                                                     |
| Maximum continuous current, Normally Open relay contacts    | 6 A                                                      |
| Maximum total thermal current $\Sigma I_{THERM}$            | 12 A                                                     |
| Minimum current                                             | 10 mA                                                    |
| Utilization category as per UL 60947-5-1                    | B300 and R300                                            |
| Utilization category as per IEC 60947-4-1 and IEC 60947-5-1 | AC-1: 250 V<br>AC-15: 250 V<br>DC-1: 24 V<br>DC-13: 24 V |
| Maximum current, normally open relay contacts               | AC-1: 5 A<br>AC-15: 3 A<br>DC-1: 5 A<br>DC-13: 3 A       |
| External fusing                                             | 10 A, category gG                                        |

## Additional Non-Safety-Related Outputs

|                 |        |
|-----------------|--------|
| Output voltage  | 24V DC |
| Maximum current | 20 mA  |

## Synchronization Times

The synchronization times for the synchronization of safety-related inputs depend on the application function. (See page 11 Function Mode Selector and Input Device Connection Example.)

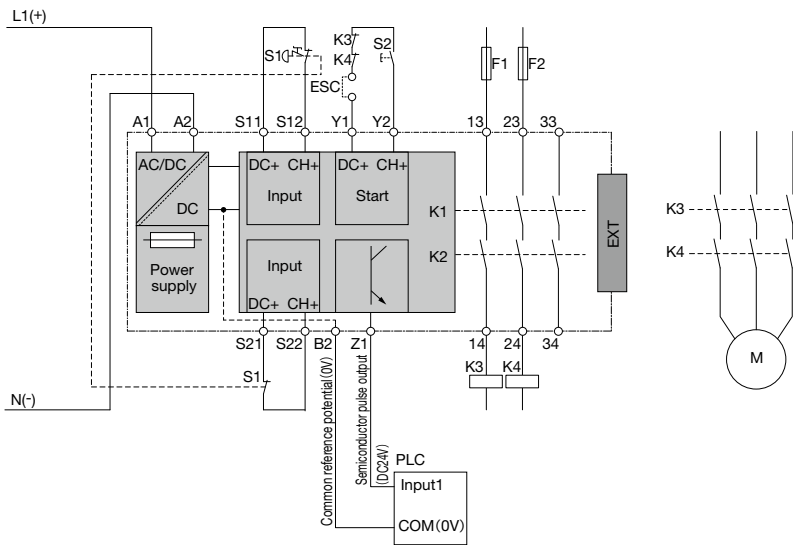
## Data Functional Safety

|                                                                                                         |                                              |                                              |
|---------------------------------------------------------------------------------------------------------|----------------------------------------------|----------------------------------------------|
| Defined safe state                                                                                      | Safety-related outputs are de-energized open |                                              |
| Maximum Performance Level (PL), Category (as per ISO 13849-1:2015)                                      | PL e, Category 4                             |                                              |
| Maximum Safety Integrity Level (SIL) (as per IEC 61508-1:2010)                                          | Normally Open: 3                             |                                              |
| Safety Integrity Level Claim Limit (SILCL) (as per IEC 62061:2005+AMD1:2012 +AMD2:2015)                 | Normally Open: 3                             |                                              |
| Type (as per IEC 61508-2)                                                                               | B                                            |                                              |
| Hardware Fault Tolerance (HFT) (as per IEC 61508 and IEC 62061)                                         | 1                                            |                                              |
| Stop Category for Emergency Stops (as per ISO 13850 and IEC 60204-1)                                    | 0                                            |                                              |
| Lifetime in years at an ambient temperature of 55 °C (131 °F)                                           | 20                                           |                                              |
| Safe Failure Fraction (SFF) (as per IEC 61508 and IEC 62061)                                            | <99 %                                        |                                              |
| Probability of Dangerous Failure per hour (PFH <sub>D</sub> ) in 1/h (as per IEC 61508 and ISO 13849-1) | 1.13 x 10 <sup>-9</sup>                      |                                              |
| Mean Time To Dangerous Failure (MTTF <sub>D</sub> ) in years (as per ISO 13849-1)                       | 2,000                                        |                                              |
| Average Diagnostic Coverage (DC <sub>avg</sub> ) (as per ISO 13849-1)                                   | ≥99 %                                        |                                              |
| Maximum number of cycles over lifetime                                                                  | DC-13                                        | 24V DC 1 A: 1,200,000<br>24V DC 3 A: 180,000 |
|                                                                                                         | AC-1                                         | 250V AC 4 A: 180,000                         |
|                                                                                                         | AC-15                                        | 250V AC 1 A: 70,000                          |
|                                                                                                         |                                              | 250V AC 5 A: 39,000                          |

For other specifications (common to all models), see page 25.

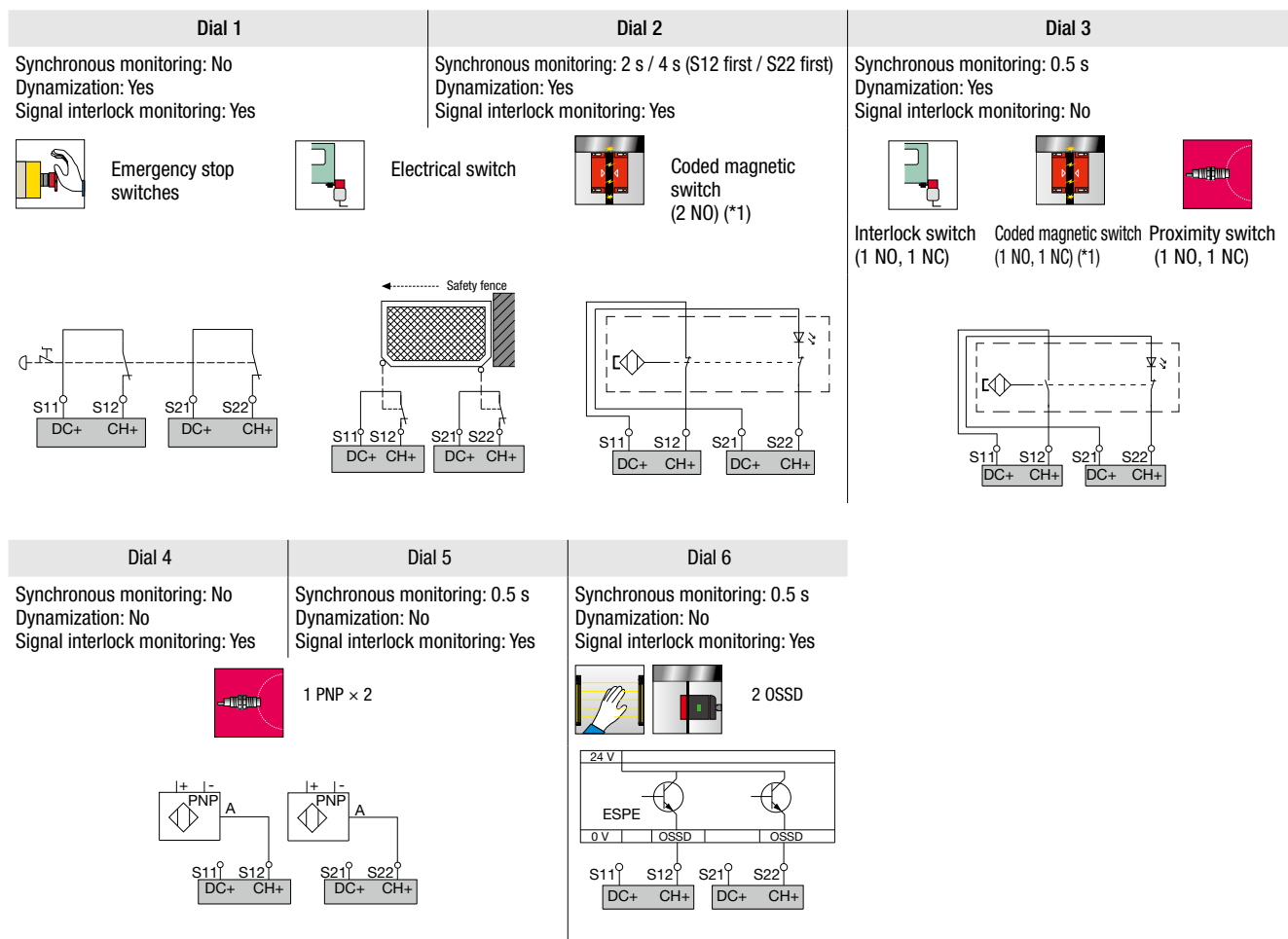
## HR6S-AF

## Wiring



| Designation | Explanation                             |
|-------------|-----------------------------------------|
| EXT         | Connector for optional expansion module |
| S1          | Emergency stop switch                   |
| S2          | Start switch                            |
| K3, K4      | Contactor                               |
| M           | Motor                                   |
| PLC         | Programmable controller                 |
| F1, F2      | Fuse                                    |

## Function Mode Selector and Input Device Connection Example



\*1: Connection examples for coded magnetic switches such as HS7A (IDEC) are also included on the instruction sheet, but certifications are not available.

Note: Status of contacts in the diagram: The status of the control switch is when it is not operated. The status of the door interlock is when the door is closed.



# HR6S-AK Safety Relay Module

## Connects to pressure-sensitive switches such as mat switches

- Protects both the operator and the machine by immediately stopping dangerous movements when instructed to stop by the operator or when a failure in the safety circuit is detected.
- Connects to pressure-sensitive switches such as mat switches or edge switches.
- NC contact is available for output.



• See website for details on approvals and standards.

HR6S-AK

Package Quantity: 1

| Terminal         | Part No.  | Supply Voltage |
|------------------|-----------|----------------|
| Push-in terminal | HR6S-AK1C | 24V AC/DC      |
| Screw terminal   | HR6S-AK1P | 24V AC/DC      |

- One sealing strip (see page 26) is included with each product.

### Overview of Application Functions



Monitoring of Emergency Stop circuits as per ISO 13850 and IEC 60204-1, stop category 0



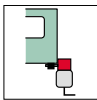
Monitoring of guards as per ISO 14119/14120 with coded magnetic switches



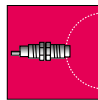
Monitoring of electro-sensitive protective equipment such as type 4 light curtains as per IEC 61496-1



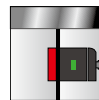
Monitoring of pressure-sensitive 4-wire protective devices such as mats or edges as per ISO 13856



Monitoring of guards as per ISO 14119/14120 with interlock switches



Monitoring of proximity switches



Monitoring of RFID sensors

### Safety-Related Outputs

|                                                             |                                                                                        |
|-------------------------------------------------------------|----------------------------------------------------------------------------------------|
| Number of relay contacts, Normally Open, instantaneous      | 2                                                                                      |
| Number of relay contacts, Normally Closed, instantaneous    | 1                                                                                      |
| Maximum short circuit current IK                            | 1 kA                                                                                   |
| Maximum continuous current, Normally Open relay contacts    | 6 A                                                                                    |
| Maximum continuous current, Normally Closed relay contacts  | 3 A                                                                                    |
| Maximum total thermal current $\Sigma I_{THERM}$            | 12 A                                                                                   |
| Minimum current                                             | 10 mA                                                                                  |
| Utilization category as per UL 60947-5-1                    | B300 and R300 for Normally Open contacts<br>D300 and R300 for Normally Closed contacts |
| Utilization category as per IEC 60947-4-1 and IEC 60947-5-1 | AC-1: 250 V<br>AC-15: 250 V<br>DC-1: 24 V<br>DC-13: 24 V                               |
| Maximum current, normally open relay contacts               | AC-1: 5 A<br>AC-15: 3 A<br>DC-1: 5 A<br>DC-13: 3 A                                     |
| Maximum current, normally closed relay contacts             | AC-1: 3 A<br>AC-15: 1 A<br>DC-1: 3 A<br>DC-13: 1 A                                     |
| External fusing                                             | 10 A, category gG, for Normally Open<br>4 A, category gG, for Normally Closed          |

### Additional Non-Safety-Related Outputs

|                 |        |
|-----------------|--------|
| Output voltage  | 24V DC |
| Maximum current | 20 mA  |

### Synchronization Times

The synchronization times for the synchronization of safety-related inputs depend on the application function. (See page 13 Function Mode Selector and Input Device Connection Example.)



Output expansion possible

\*Available in February 2021.

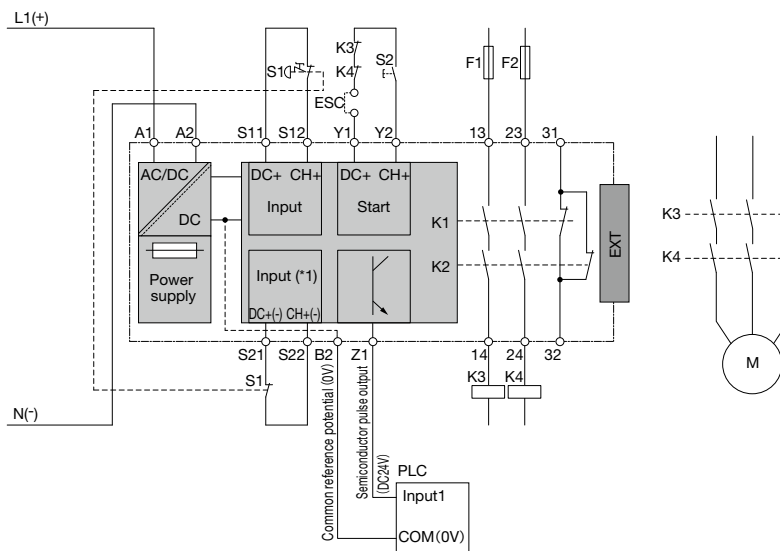
### Data Functional Safety

|                                                                                                         |                                                                                           |                                              |
|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|----------------------------------------------|
| Defined safe state                                                                                      | Safety-related outputs are de-energized<br>Normally Open: open<br>Normally Closed: closed |                                              |
| Maximum Performance Level (PL), Category (as per ISO 13849-1:2015)                                      | Normally Open: PL e, Category 4<br>Normally Closed: PLc, Category 1                       |                                              |
| Maximum Safety Integrity Level (SIL) (as per IEC 61508-1:2010)                                          | Normally Open: 3<br>Normally Closed: 1                                                    |                                              |
| Safety Integrity Level Claim Limit (SILCL) (as per IEC 62061:2005+AMD1:2012+AMD2:2015)                  | Normally Open: 3<br>Normally Closed: 1                                                    |                                              |
| Type (as per IEC 61508-2)                                                                               | B                                                                                         |                                              |
| Hardware Fault Tolerance (HFT) (as per IEC 61508 and IEC 62061)                                         | 1                                                                                         |                                              |
| Stop Category for Emergency Stops (as per ISO 13850 and IEC 60204-1)                                    | 0                                                                                         |                                              |
| Lifetime in years at an ambient temperature of 55 °C (131 °F)                                           | 20                                                                                        |                                              |
| Safe Failure Fraction (SFF) (as per IEC 61508 and IEC 62061)                                            | >99 %                                                                                     |                                              |
| Probability of Dangerous Failure per hour (PFH <sub>D</sub> ) in 1/h (as per IEC 61508 and ISO 13849-1) | 1.13 x 10 <sup>-9</sup>                                                                   |                                              |
| Mean Time To Dangerous Failure (MTTF <sub>D</sub> ) in years (as per ISO 13849-1)                       | 2,000                                                                                     |                                              |
| Average Diagnostic Coverage (DC <sub>avg</sub> ) (as per ISO 13849-1)                                   | ≥99 %                                                                                     |                                              |
| Maximum number of cycles over lifetime                                                                  | DC-13                                                                                     | 24V DC 1 A: 1,200,000<br>24V DC 3 A: 180,000 |
|                                                                                                         | AC-1                                                                                      | 250V AC 4 A: 180,000<br>250V AC 1 A: 70,000  |
|                                                                                                         | AC-15                                                                                     | 250V AC 5 A: 39,000                          |
|                                                                                                         |                                                                                           |                                              |

For other specifications (common to all models), see page 25.

## HR6S-AK

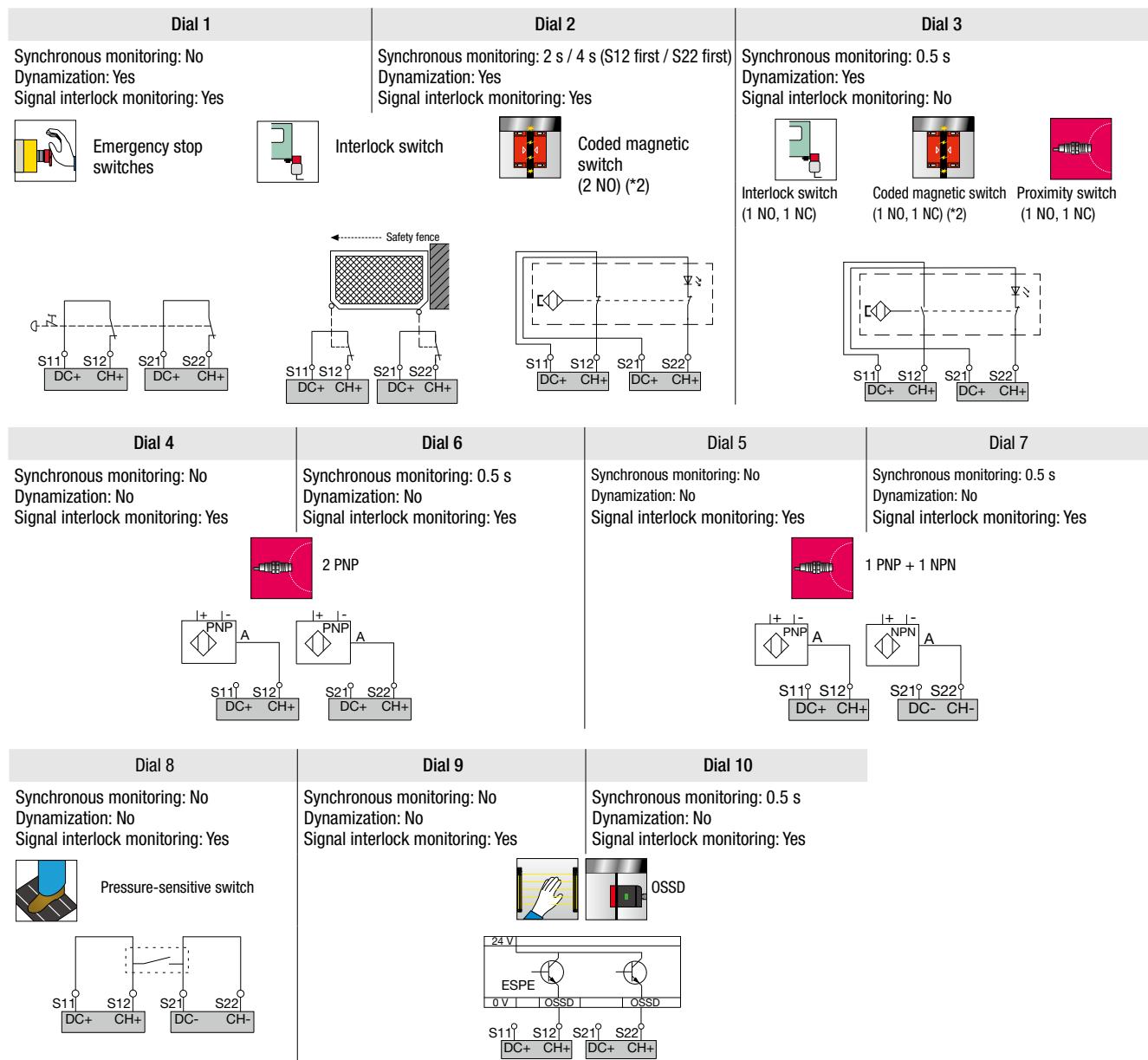
## Wiring



| Designation | Explanation                             |
|-------------|-----------------------------------------|
| EXT         | Connector for optional expansion module |
| S1          | Emergency stop switch                   |
| S2          | Start switch                            |
| K3, K4      | Contactor                               |
| PLC         | Programmable controller                 |
| F1, F2      | Fuse                                    |

\*1: The application function sets the negative safe-related input according to the input device.

## Function Mode Selector and Input Device Connection Example



\*2: Connection examples for coded magnetic switches such as HS7A (IDEC) are also included on the instruction sheet, but certifications are not available.

# HR6S-AT Safety Relay Module

## Equipped with time delay output for Stop Category 0 and Stop Category 1

- Protects both the operator and the machine by immediately stopping dangerous movements (stop category 0) when instructed to stop by the operator or when a failure in the safety circuit is detected. Also, the safety module is equipped with a stop category 1 delay output, which allows the motor to stop after deceleration.
- The selector on the front can be used to set the delay time to a value from 0.1 seconds to 15 minutes. (Can also be set to 0 seconds.)
- The delay output can be canceled by the S21-S22 or S31-S32 terminal (vacant terminal), and the delay output is immediately cut off when canceled.



Output expansion possible

\*Available in February 2021.

### HR6S-AT

Package Quantity: 1

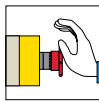
| Terminal         | Part No.  | Supply Voltage |
|------------------|-----------|----------------|
| Push-in terminal | HR6S-AT1C | 24V AC/DC      |
| Screw terminal   | HR6S-AT1P | 24V AC/DC      |

- One sealing strip (see page 26) is included with each product.



- See website for details on approvals and standards.

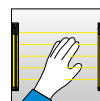
### Overview of Application Functions



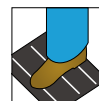
Monitoring of Emergency Stop circuits as per ISO 13850 and IEC 60204-1, stop category 0, 1



Monitoring of guards as per ISO 14119/14120 with coded magnetic switches



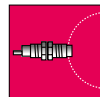
Monitoring of electro-sensitive protective equipment such as type 4 light curtains as per IEC 61496-1



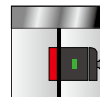
Monitoring of pressure-sensitive 4-wire protective devices such as mats or edges as per ISO 13856



Monitoring of guards as per ISO 14119/14120 with interlock switches



Monitoring of proximity switches



Monitoring of RFID sensors

### Safety-Related Outputs

|                                                             |                                                                                        |
|-------------------------------------------------------------|----------------------------------------------------------------------------------------|
| Number of relay contacts, Normally Open, instantaneous      | 3                                                                                      |
| Number of relay contacts, Normally Open, delayed            | 3                                                                                      |
| Number of relay contacts, Normally Closed, delayed          | 1                                                                                      |
| Maximum short circuit current I <sub>K</sub>                | 1 kA                                                                                   |
| Maximum continuous current, Normally Open relay contacts    | 6 A                                                                                    |
| Maximum continuous current, Normally Closed relay contacts  | 3 A                                                                                    |
| Maximum total thermal current $\Sigma I_{THERM}$            | 12 A                                                                                   |
| Minimum current                                             | 10 mA                                                                                  |
| Utilization category as per UL 60947-5-1                    | B300 and R300 for Normally Open contacts<br>D300 and R300 for Normally Closed contacts |
| Utilization category as per IEC 60947-4-1 and IEC 60947-5-1 | AC-1: 250 V<br>AC-15: 250 V<br>DC-1: 24 V<br>DC-13: 24 V                               |
| Maximum current, normally open relay contacts               | AC-1: 5 A<br>AC-15: 3 A<br>DC-1: 5 A<br>DC-13: 3 A                                     |
| Maximum current, normally closed relay contacts             | AC-1: 3 A<br>AC-15: 1 A<br>DC-1: 3 A<br>DC-13: 1 A                                     |
| External fusing                                             | 10 A, category gG, for Normally Open<br>4 A, category gG, for Normally Closed          |

### Delay Times for Delay Function of Safety-Related Outputs

|                 |                                                                                                                                                                                                                                      |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Possible values | 0 s, 0.1 s, 0.2 s, 0.3 s, 0.4 s, 0.5 s, 0.6 s, 0.7 s, 0.8 s, 0.9 s, 1 s, 2 s, 3 s, 4 s, 5 s, 6 s, 7 s, 8 s, 9 s, 10 s, 20 s, 30 s, 40 s, 50 s, 60 s, 70 s, 80 s, 90 s, 100 s, 200 s, 300 s, 400 s, 500 s, 600 s, 700 s, 800 s, 900 s |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### Additional Non-Safety-Related Outputs

|                 |        |
|-----------------|--------|
| Output voltage  | 24V DC |
| Maximum current | 20 mA  |

### Synchronization Times

The synchronization times for the synchronization of safety-related inputs depend on the application function. (See page 16 Function Mode Selector and Input Device Connection Example.)

For other specifications (common to all models), see page 25.

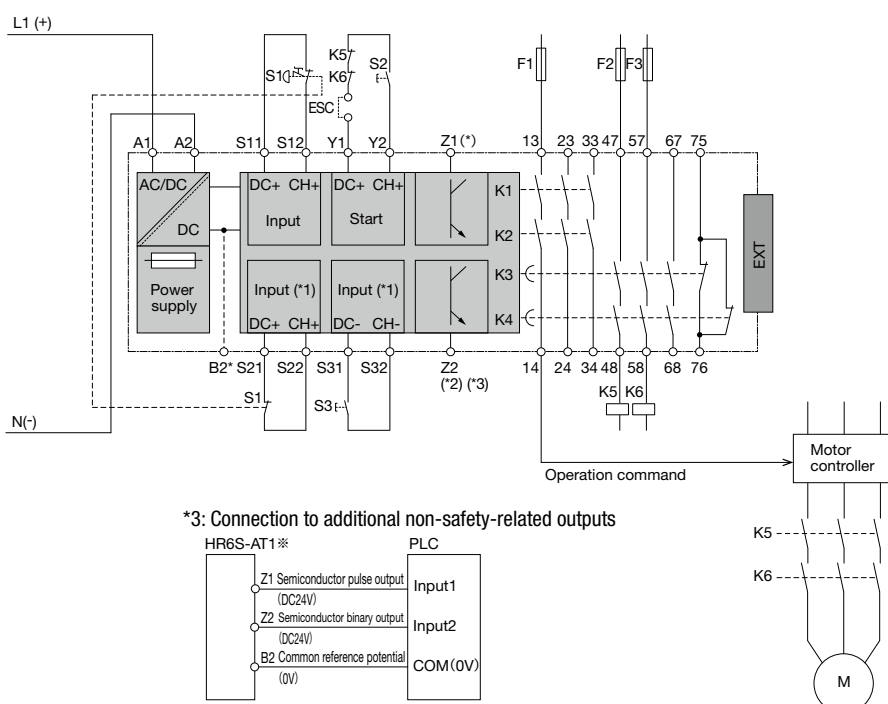
## HR6S-AT

## Data Functional Safety

|                                                                                                            |       |                                                                                              |
|------------------------------------------------------------------------------------------------------------|-------|----------------------------------------------------------------------------------------------|
| Defined safe state                                                                                         |       | Safety-related outputs are de-energized<br>Normally Open: open<br>Normally Closed: closed    |
| Maximum Performance Level (PL), Category (as per ISO 13849-1:2015)                                         |       | Normally Open: PL <sub>e</sub> , Category 4<br>Normally Closed: PL <sub>c</sub> , Category 1 |
| Maximum Safety Integrity Level (SIL)<br>(as per IEC 61508-1:2010)                                          |       | Normally Open: 3<br>Normally Closed: 1                                                       |
| Safety Integrity Level Claim Limit (SILCL)<br>(as per IEC 62061:2005+AMD1:2012+AMD2:2015)                  |       | Normally Open: 3<br>Normally Closed: 1                                                       |
| Type (as per IEC 61508-2)                                                                                  |       | B                                                                                            |
| Hardware Fault Tolerance (HFT) (as per IEC 61508 and IEC 62061)                                            |       | 1                                                                                            |
| Stop Category for Emergency Stops<br>(as per ISO 13850 and IEC 60204-1)                                    |       | 0 or 1                                                                                       |
| Lifetime in years at an ambient temperature of 55 °C (131 °F)                                              |       | 20                                                                                           |
| Safe Failure Fraction (SFF)<br>(as per IEC 61508 and IEC 62061)                                            |       | >99 %                                                                                        |
| Probability of Dangerous Failure per hour (PFH <sub>D</sub> ) in 1/h<br>(as per IEC 61508 and ISO 13849-1) |       | 0.94 × 10 <sup>-9</sup> for Stop Category 0<br>0.95 × 10 <sup>-9</sup> for Stop Category 1   |
| Mean Time To Dangerous Failure (MTTF <sub>D</sub> ) in years<br>(as per ISO 13849-1)                       |       | 2,400 for Stop Category 0<br>2,300 for Stop Category 1                                       |
| Average Diagnostic Coverage (DC <sub>avg</sub> )<br>(as per ISO 13849-1)                                   |       | ≥99 %                                                                                        |
| Maximum number of cycles over lifetime                                                                     | DC-13 | 24V DC 1 A: 1200000 with Stop Category 0                                                     |
|                                                                                                            |       | 24V DC 1 A: 1200000 with Stop Category 1                                                     |
|                                                                                                            |       | 24V DC 3 A: 180000 with Stop Category 0                                                      |
|                                                                                                            |       | 24V DC 3 A: 275000 with Stop Category 1                                                      |
|                                                                                                            | AC-1  | 250V AC 4 A: 180000 with Stop Category 0                                                     |
|                                                                                                            |       | 250 VAC 4 A: 90000 with Stop Category 1                                                      |
|                                                                                                            | AC-15 | 250V AC 1 A: 70000 with Stop Category 0                                                      |
|                                                                                                            |       | 250V AC 1 A: 90000 with Stop Category 1                                                      |
|                                                                                                            |       | 250V AC 3 A: 39000 with Stop Category 0                                                      |
|                                                                                                            |       | 250V AC 3 A: 60000 with Stop Category 1                                                      |

For other specifications (common to all models), see page 25.

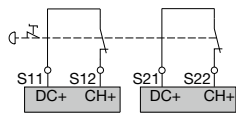
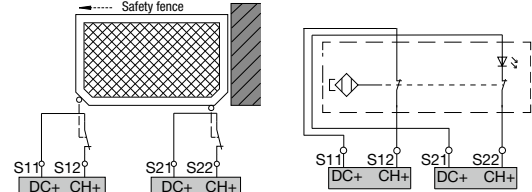
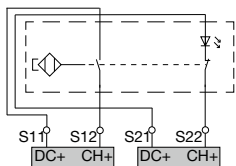
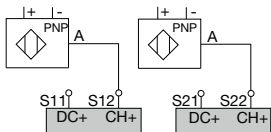
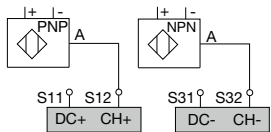
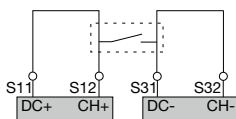
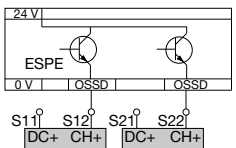
## Wiring Example





## HR6S-AT

## Function Mode Selector and Input Device Connection Example

| Dial 1                                                                                                        | Dial 2                                                                                                             |                                                                                                                     | Dial 3                                                                                                                                                                                                                                                                                                                                                                |
|---------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Synchronous monitoring: No<br>Dynamization: Yes<br>Signal interlock monitoring: Yes                           | Synchronous monitoring: 2 s / 4 s (S12 first / S22 first)<br>Dynamization: Yes<br>Signal interlock monitoring: Yes |                                                                                                                     | Synchronous monitoring: 0.5 s<br>Dynamization: Yes<br>Signal interlock monitoring: No                                                                                                                                                                                                                                                                                 |
|  Emergency stop switches     |  Interlock switch                 |  Coded magnetic switch (2 NO) (*2) |  Interlock switch (1 NO, 1 NC)<br> Coded magnetic switch (2 NO, 1 NC) (*1)<br> Proximity switch (1 NO, 1 NC) |
|                              |                                   |                                                                                                                     |                                                                                                                                                                                                                                                                                    |
| Dial 4                                                                                                        | Dial 6                                                                                                             | Dial 5                                                                                                              | Dial 7                                                                                                                                                                                                                                                                                                                                                                |
| Synchronous monitoring: No<br>Dynamization: No<br>Signal interlock monitoring: Yes                            | Synchronous monitoring: 0.5 s<br>Dynamization: No<br>Signal interlock monitoring: Yes                              | Synchronous monitoring: No<br>Dynamization: No<br>Signal interlock monitoring: Yes                                  | Synchronous monitoring: 0.5 s<br>Dynamization: No<br>Signal interlock monitoring: Yes                                                                                                                                                                                                                                                                                 |
|  2 PNP                      |                                                                                                                    |                                                                                                                     |  1 PNP + 1 NPN                                                                                                                                                                                                                                                                     |
|                            |                                                                                                                    |                                                                                                                     |                                                                                                                                                                                                                                                                                   |
| Dial 8                                                                                                        | Dial 9                                                                                                             | Dial 10                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                       |
| Synchronous monitoring: No<br>Dynamization: No<br>Signal interlock monitoring: Yes                            | Synchronous monitoring: No<br>Dynamization: No<br>Signal interlock monitoring: Yes                                 | Synchronous monitoring: 0.5 s<br>Dynamization: No<br>Signal interlock monitoring: Yes                               |                                                                                                                                                                                                                                                                                                                                                                       |
|  Pressure-sensitive switch |  2 OSSD                         |                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                       |
|                            |                                 |                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                       |

\*2: Connection examples for coded magnetic switches such as HS7A (IDEC) are also included on the instruction sheet, but certifications are not available. Also, for 2NO, use dial 1 or 2.

Note: Status of contacts in the diagram: The status of the control switch is when it is not operated. The status of the door interlock is when the door is closed.

# HR6S-S Safety Relay Module

## Monitoring of two hand control devices (IIIA or IIIC)

- Monitors two-hand control devices (IIIA or IIIC) that are required to comply with International Standard ISO 13851.
- IIIC can monitor two-hand pushbuttons for synchronization within 0.5 seconds.
- If one of the two buttons is released during operation, the control sequence is canceled.
- Connects up to two input devices in parallel (except for two-hand control devices (IIIC)). (Outputs are enabled when all inputs are enabled.)



Output expansion possible

### HR6S-S

Package Quantity: 1

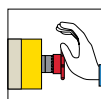
| Terminal         | Part No. | Supply Voltage |
|------------------|----------|----------------|
| Push-in terminal | HR6S-S1C | 24V AC/DC      |
| Screw terminal   | HR6S-S1P | 24V AC/DC      |



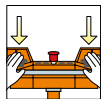
• See website for details on approvals and standards.

- One sealing strip (see page 26) is included with each product.

### Overview of Application Functions



Monitoring of Emergency Stop circuits as per ISO 13850 and IEC 60204-1, stop category 0



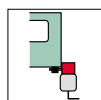
Monitoring of two-hand control devices, type III C as per ISO 13851



Monitoring of proximity switches



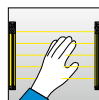
Monitoring of RFID sensors



Monitoring of guards as per ISO 14119/14120 with interlock switches



Monitoring of guards as per ISO 14119/14120 with coded magnetic switches



Monitoring of electro-sensitive protective equipment such as type 4 light curtains as per IEC 61496-1

### Safety-Related Outputs

|                                                             |                                                          |
|-------------------------------------------------------------|----------------------------------------------------------|
| Number of relay contacts, Normally Open, instantaneous      | 2                                                        |
| Maximum short circuit current IK                            | 1 kA                                                     |
| Maximum continuous current, Normally Open relay contacts    | 6 A                                                      |
| Maximum total thermal current $\Sigma I_{THERM}$            | 12 A                                                     |
| Minimum current                                             | 10 mA                                                    |
| Utilization category as per UL 60947-5-1                    | B300 and R300                                            |
| Utilization category as per IEC 60947-4-1 and IEC 60947-5-1 | AC-1: 250 V<br>AC-15: 250 V<br>DC-1: 24 V<br>DC-13: 24 V |
| Maximum current, normally open relay contacts               | AC-1: 5 A<br>AC-15: 3 A<br>DC-1: 5 A<br>DC-13: 3 A       |
| External fusing                                             | 10 A, category gG                                        |

### Additional Non-Safety-Related Outputs

|                 |        |
|-----------------|--------|
| Output voltage  | 24V DC |
| Maximum current | 20 mA  |

### Synchronization Times

The synchronization times for the synchronization of safety-related inputs depend on the application function. (See page 18 to 19 Function Mode Selector and Input Device Connection Example.)

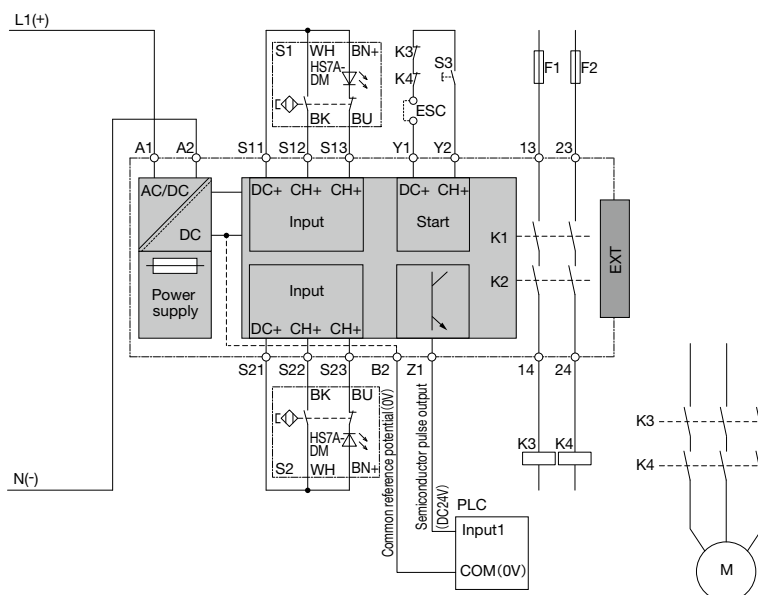
For other specifications (common to all models), see page 25.

### Data Functional Safety

|                                                                                                         |                                                                |                                           |
|---------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|-------------------------------------------|
| Defined safe state                                                                                      | Safety-related outputs are de-energized<br>Normally Open: open |                                           |
| Maximum Performance Level (PL), Category (as per ISO 13849-1:2015)                                      | Normally Open: PLe, Category 4                                 |                                           |
| Maximum Safety Integrity Level (SIL) (as per IEC 61508-1:2010)                                          | Normally Open: 3                                               |                                           |
| Safety Integrity Level Claim Limit (SILCL) (as per IEC 62061:2005+AMD1:2012+AMD2:2015)                  | Normally Open: 3                                               |                                           |
| Type (as per IEC 61508-2)                                                                               | B                                                              |                                           |
| Hardware Fault Tolerance (HFT) (as per IEC 61508 and IEC 62061)                                         | 1                                                              |                                           |
| Stop Category for Emergency Stops (as per ISO 13850 and IEC 60204-1)                                    | 0                                                              |                                           |
| Lifetime in years at an ambient temperature of 55 °C (131 °F)                                           | 20                                                             |                                           |
| Safe Failure Fraction (SFF) (as per IEC 61508 and IEC 62061)                                            | >99 %                                                          |                                           |
| Probability of Dangerous Failure per hour (PFH <sub>D</sub> ) in 1/h (as per IEC 61508 and ISO 13849-1) | 1.13 × 10 <sup>-9</sup>                                        |                                           |
| Mean Time To Dangerous Failure (MTTF <sub>D</sub> ) in years (as per ISO 13849-1)                       | 2,000                                                          |                                           |
| Average Diagnostic Coverage (DC <sub>avg</sub> ) (as per ISO 13849-1)                                   | ≥99 %                                                          |                                           |
| Maximum number of cycles over lifetime                                                                  | DC-13                                                          | 24V DC 1 A: 1200000<br>24V DC 3 A: 180000 |
|                                                                                                         | AC-1                                                           | 250V AC 4 A: 180000<br>250V AC 1 A: 70000 |
|                                                                                                         | AC-15                                                          | 250V AC 5 A: 39000                        |
|                                                                                                         |                                                                |                                           |

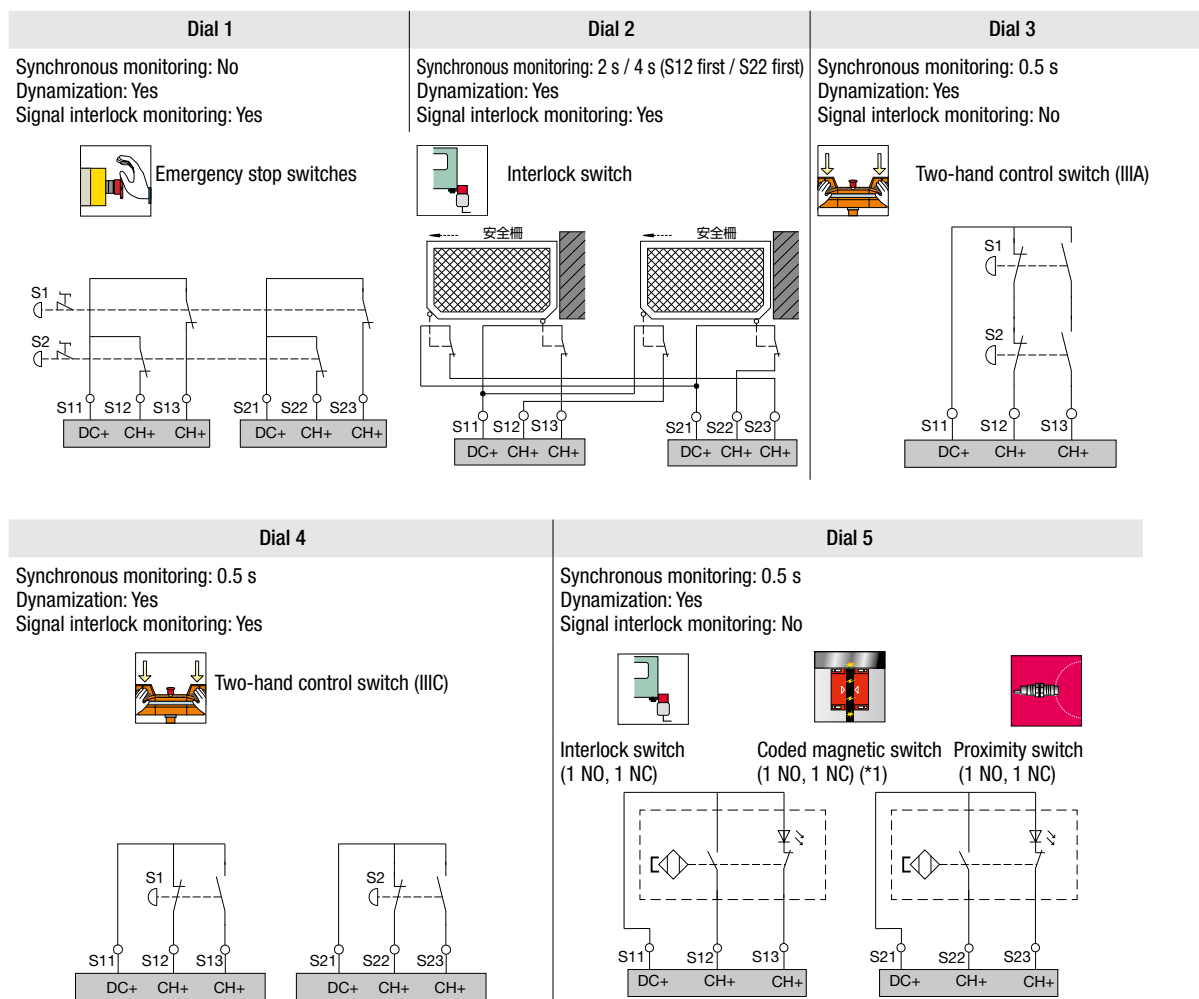
## HR6S-S

## Wiring Example

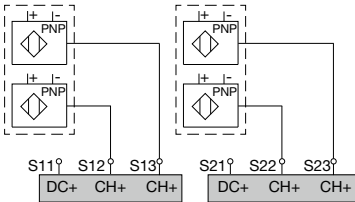
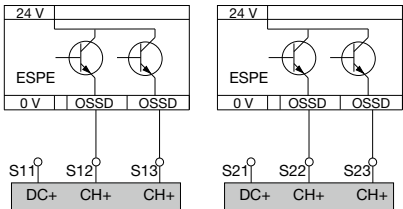
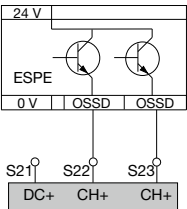


| Designation | Explanation                             |
|-------------|-----------------------------------------|
| EXT         | Connector for optional expansion module |
| S1, S2      | Non-contact interlock switch            |
| S3          | Start switch                            |
| K3, K4      | Contactors                              |
| PLC         | Programmable controller                 |
| F1, F2      | Fuse                                    |

## Function Mode Selector and Input Device Connection Example



\*1: Connection examples for coded magnetic switches such as HS7A (IDEC) are also included on the instruction sheet, but certifications are not available.

| Dial 7                                                                                                                                                                           | Dial 8                                                                                         | Dial 9                                                                                                                                                                              | Dial 10                                                                                                                                                                               |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Synchronous monitoring: No<br/>Dynamization: No<br/>Signal interlock monitoring: Yes</p>                                                                                      | <p>Synchronous monitoring: 0.5 s<br/>Dynamization: No<br/>Signal interlock monitoring: Yes</p> | <p>Synchronous monitoring: No<br/>Dynamization: No<br/>Signal interlock monitoring: Yes</p>                                                                                         | <p>Synchronous monitoring: 0.5 s<br/>Dynamization: No<br/>Signal interlock monitoring: Yes</p>                                                                                        |
|  2 PNP × 2<br> |                                                                                                |  2 OSSD × 2<br> |  2 OSSD × 2<br> |



# HR6S-DN Safety Relay Module

## Up to 6 safety-related inputs can be connected

- Protects both the operator and the machine by immediately stopping dangerous movements when instructed to stop by the operator or when a failure in the safety circuit is detected.
- Connects up to 6 input devices in parallel.  
(Outputs are enabled when all inputs are enabled.)

### HR6S-DN

Package Quantity: 1

| Terminal         | Part No.  | Supply Voltage |
|------------------|-----------|----------------|
| Push-in terminal | HR6S-DN1C | 24V AC/DC      |
| Screw terminal   | HR6S-DN1P | 24V AC/DC      |

- One sealing strip (see page 26) is included with each product.

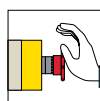


Output expansion possible

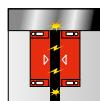


- See website for details on approvals and standards.

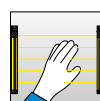
### Overview of Application Functions



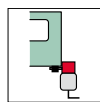
Monitoring of Emergency Stop circuits as per ISO 13850 and IEC 60204-1, stop category 0



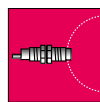
Monitoring of guards as per ISO 14119/14120 with coded magnetic switches



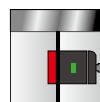
Monitoring of electro-sensitive protective equipment such as type 4 light curtains as per IEC 61496-1



Monitoring of guards as per ISO 14119/14120 with interlock switches



Monitoring of proximity switches



Monitoring of RFID sensors

### Safety-Related Outputs

|                                                             |                                                                                        |
|-------------------------------------------------------------|----------------------------------------------------------------------------------------|
| Number of relay contacts, Normally Open, instantaneous      | 3                                                                                      |
| Number of relay contacts, Normally Closed, instantaneous    | 1                                                                                      |
| Maximum short circuit current I <sub>K</sub>                | 1 kA                                                                                   |
| Maximum continuous current, Normally Open relay contacts    | 6 A                                                                                    |
| Maximum continuous current, Normally Closed relay contacts  | 3 A                                                                                    |
| Maximum total thermal current $\Sigma I_{THERM}$            | 12 A                                                                                   |
| Minimum current                                             | 10 mA                                                                                  |
| Utilization category as per UL 60947-5-1                    | B300 and R300 for Normally Open contacts<br>D300 and R300 for Normally Closed contacts |
| Utilization category as per IEC 60947-4-1 and IEC 60947-5-1 | AC-1: 250 V<br>AC-15: 250 V<br>DC-1: 24 V<br>DC-13: 24 V                               |
| Maximum current, normally open relay contacts               | AC-1: 5 A<br>AC-15: 3 A<br>DC-1: 5 A<br>DC-13: 3 A                                     |
| Maximum current, normally closed relay contacts             | AC-1: 3 A<br>AC-15: 1 A<br>DC-1: 3 A<br>DC-13: 1 A                                     |
| External fusing                                             | 10 A, category gG, for Normally Open<br>4 A, category gG, for Normally Closed          |

### Additional Non-Safety-Related Outputs

|                 |        |
|-----------------|--------|
| Output voltage  | 24V DC |
| Maximum current | 20 mA  |

### Data Functional Safety

|                                                                                                         |                                                                                           |                                           |
|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------|
| Defined safe state                                                                                      | Safety-related outputs are de-energized<br>Normally Open: open<br>Normally Closed: closed |                                           |
| Maximum Performance Level (PL), Category (as per ISO 13849-1:2015)                                      | Normally Open: PLe, Category 4<br>Normally Closed: PLC, Category 1                        |                                           |
| Maximum Safety Integrity Level (SIL) (as per IEC 61508-1:2010)                                          | Normally Open: 3<br>Normally Closed: 1                                                    |                                           |
| Safety Integrity Level Claim Limit (SILCL) (as per IEC 62061:2005+AMD1:2012+AMD2:2015)                  | Normally Open: 3<br>Normally Closed: 1                                                    |                                           |
| Type (as per IEC 61508-2)                                                                               | B                                                                                         |                                           |
| Hardware Fault Tolerance (HFT) (as per IEC 61508 and IEC 62061)                                         | 1                                                                                         |                                           |
| Stop Category for Emergency Stops (as per ISO 13850 and IEC 60204-1)                                    | 0                                                                                         |                                           |
| Lifetime in years at an ambient temperature of 55 °C (131 °F)                                           | 20                                                                                        |                                           |
| Safe Failure Fraction (SFF) (as per IEC 61508 and IEC 62061)                                            | >99 %                                                                                     |                                           |
| Probability of Dangerous Failure per hour (PFH <sub>D</sub> ) in 1/h (as per IEC 61508 and ISO 13849-1) | 0.88 × 10 <sup>-9</sup>                                                                   |                                           |
| Mean Time To Dangerous Failure (MTTF <sub>D</sub> ) in years (as per ISO 13849-1)                       | 2,500                                                                                     |                                           |
| Average Diagnostic Coverage (DC <sub>avg</sub> ) (as per ISO 13849-1)                                   | ≥99 %                                                                                     |                                           |
| Maximum number of cycles over lifetime                                                                  | DC-13                                                                                     | 24V DC 1 A: 1200000<br>24V DC 3 A: 275000 |
|                                                                                                         | AC-1                                                                                      | 250V AC 4 A: 90000                        |
|                                                                                                         | AC-15                                                                                     | 250V AC 1 A: 90000                        |
|                                                                                                         |                                                                                           | 250V AC 5 A: 60000                        |

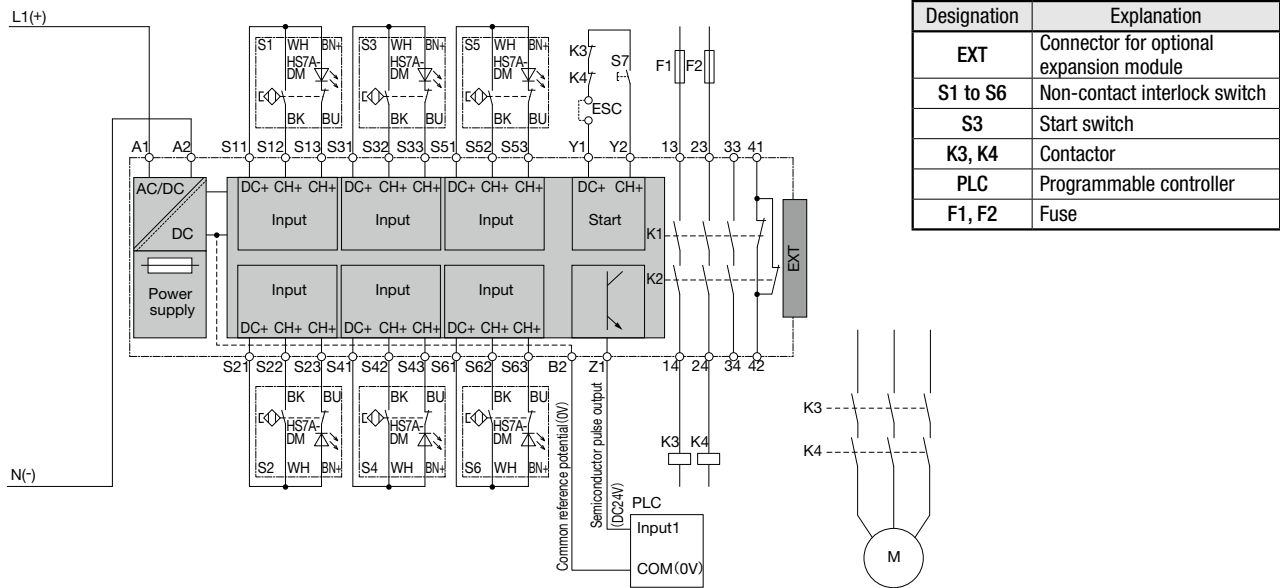
### Synchronization Times

The synchronization times for the synchronization of safety-related inputs depend on the application function. (See page 21 to 22 Function Mode Selector and Input Device Connection Example.)

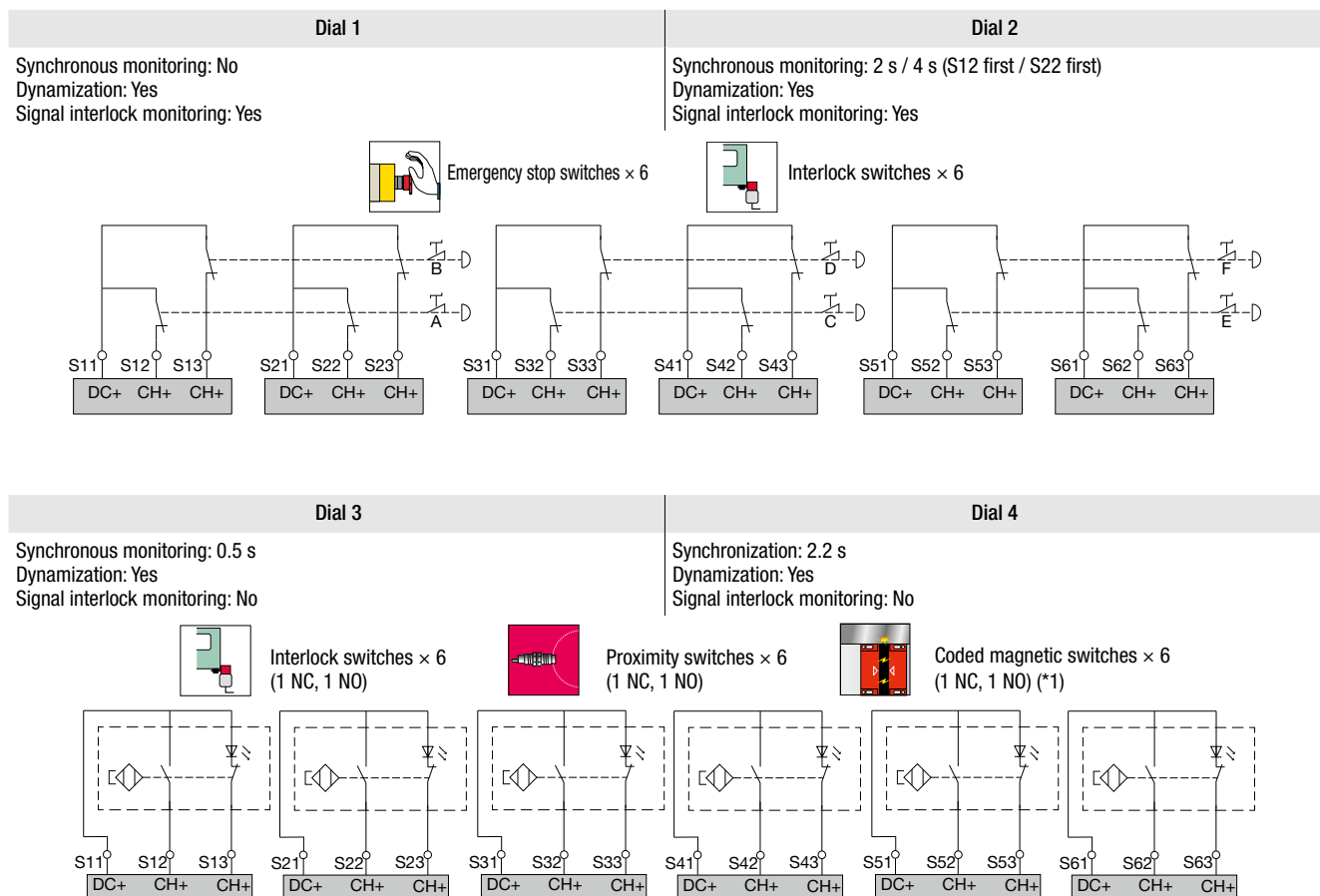
For other specifications (common to all models), see page 25.

## HR6S-DN

## Wiring Example



## Function Mode Selector and Input Device Connection Example



\*1: Connection examples for coded magnetic switches such as HS7A (IDEC) are also included on the instruction sheet, but certifications are not available.

Note: Status of contacts in the diagram: The status of the control switch is when it is not operated. The status of the door interlock is when the door is closed.

# HR6S-DN

Dial 5

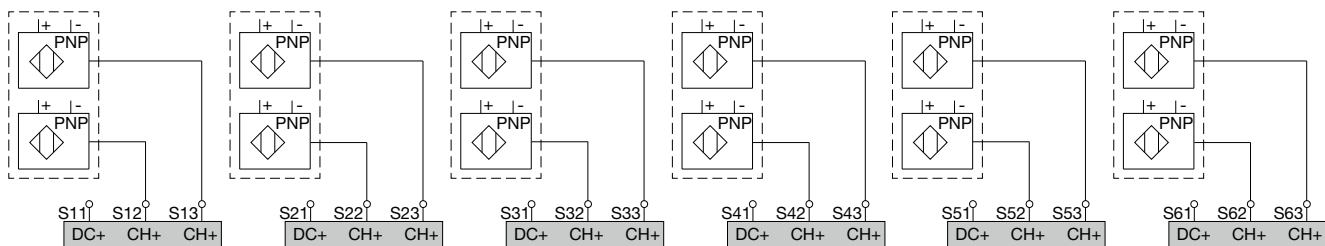
Synchronous monitoring: No  
Dynamization: No  
Signal interlock monitoring: Yes

Dial 6

Synchronization: 0.5 s  
Dynamization: No  
Signal interlock monitoring: Yes



2 PNP × 6



Dial 7

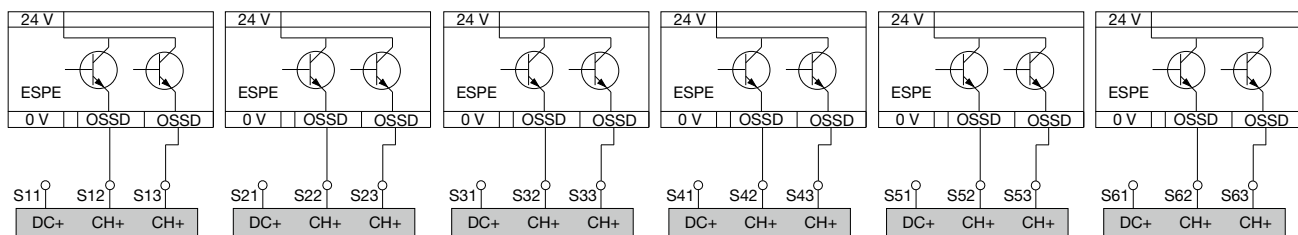
Synchronous monitoring: No  
Dynamization: No  
Signal interlock monitoring: Yes

Dial 8

Synchronization: 0.5 s  
Dynamization: No  
Signal interlock monitoring: Yes



2 OSSD × 6



# HR6S-EP Expansion Module

## Module for Extending Safety-Related Outputs

- 4 NO + 2 NC outputs can be added with the HR6S-EP.
- When connected to the HR6S-AT, you can use the HR6S-AT selector to select either instantaneous output or the delayed output.



• See website for details on approvals and standards.



\*Not applicable to HR6S-AB

### HR6S-EP

Package Quantity: 1

| Terminal         | Part No.  | Supply Voltage |
|------------------|-----------|----------------|
| Push-in terminal | HR6S-EP1C | 24V AC/DC      |
| Screw terminal   | HR6S-EP1P | 24V AC/DC      |

- One sealing strip (see page 26) is included with each product.

### Safety-Related Outputs

|                                                             |                                                                                        |
|-------------------------------------------------------------|----------------------------------------------------------------------------------------|
| Number of relay contacts, Normally Open (*1)                | 4                                                                                      |
| Number of relay contacts, Normally Closed (*1)              | 2                                                                                      |
| Maximum short circuit current IK                            | 1 kA                                                                                   |
| Maximum continuous current, Normally Open relay contacts    | 6 A                                                                                    |
| Maximum continuous current, Normally Closed relay contacts  | 3 A                                                                                    |
| Maximum total thermal current $\sum I_{THERM}$              | 12 A                                                                                   |
| Minimum current                                             | 10 mA                                                                                  |
| Utilization category as per UL 60947-5-1                    | B300 and R300 for Normally Open contacts<br>D300 and R300 for Normally Closed contacts |
| Utilization category as per IEC 60947-4-1 and IEC 60947-5-1 | AC-1: 250 V<br>AC-15: 250 V<br>DC-1: 24 V<br>DC-13: 24 V                               |
| Maximum current, normally open relay contacts               | AC-1: 5 A<br>AC-15: 3 A<br>DC-1: 5 A<br>DC-13: 3 A                                     |
| Maximum current, normally closed relay contacts             | AC-1: 3 A<br>AC-15: 1 A<br>DC-1: 3 A<br>DC-13: 1 A                                     |
| External fusing                                             | 10 A, category gG, for Normally Open<br>4 A, category gG, for Normally Closed          |

\*1: Depending on the configuration of the base safety module, the relay contacts can be used as instantaneous or delayed relay contacts.

### Additional Non-Safety-Related Outputs

|                 |        |
|-----------------|--------|
| Output voltage  | 24V DC |
| Maximum current | 20 mA  |

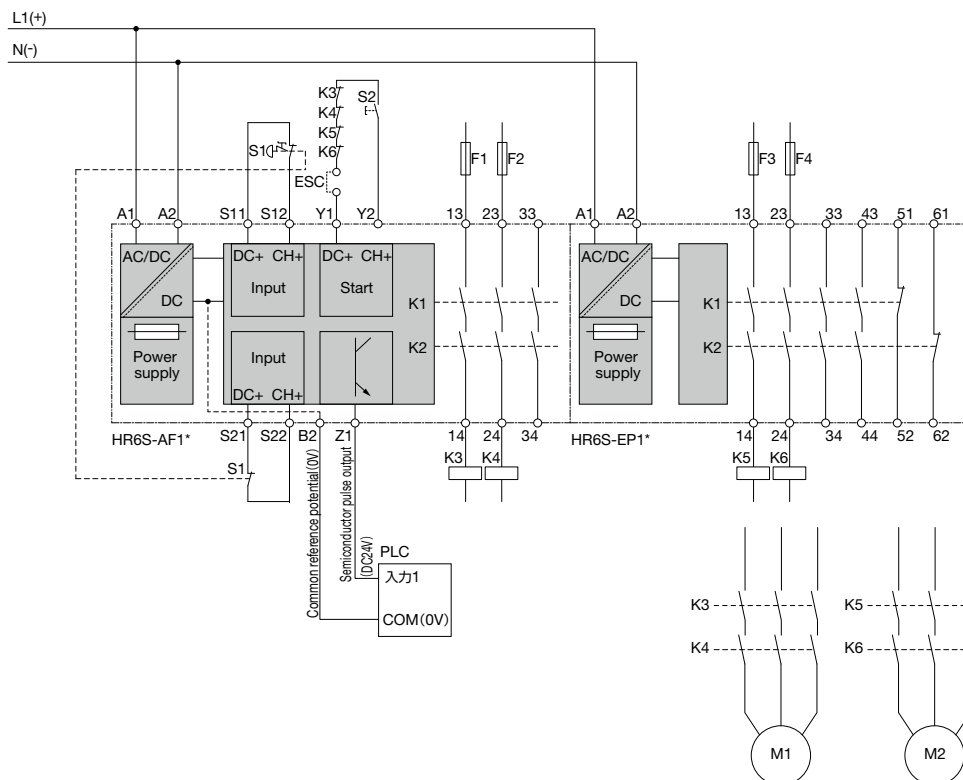
### Data Functional Safety

|                                                                                                         |                                                                                           |                                           |
|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------|
| Defined safe state                                                                                      | Safety-related outputs are de-energized<br>Normally Open: open<br>Normally Closed: closed |                                           |
| Maximum Performance Level (PL), Category (as per ISO 13849-1:2015)                                      | Normally Open: PLe, Category 4<br>Normally Closed: PLc, Category 1                        |                                           |
| Maximum Safety Integrity Level (SIL) (as per IEC 61508-1:2010)                                          | Normally Open: 3<br>Normally Closed: 1                                                    |                                           |
| Safety Integrity Level Claim Limit (SILCL) (as per IEC 62061:2005+AMD1:2012+AMD2:2015)                  | Normally Open: 3<br>Normally Closed: 1                                                    |                                           |
| Type (as per IEC 61508-2)                                                                               | A                                                                                         |                                           |
| Hardware Fault Tolerance (HFT) (as per IEC 61508 and IEC 62061)                                         | 1                                                                                         |                                           |
| Stop Category for Emergency Stops (as per ISO 13850 and IEC 60204-1)                                    | 0 or 1, depends on base safety module                                                     |                                           |
| Lifetime in years at an ambient temperature of 55 °C (131 °F)                                           | 20                                                                                        |                                           |
| Safe Failure Fraction (SFF) (as per IEC 61508 and IEC 62061)                                            | >99 %                                                                                     |                                           |
| Probability of Dangerous Failure per hour (PFH <sub>D</sub> ) in 1/h (as per IEC 61508 and ISO 13849-1) | $0.97 \times 10^{-9}$                                                                     |                                           |
| Mean Time To Dangerous Failure (MTTF <sub>D</sub> ) in years (as per ISO 13849-1)                       | 2,300                                                                                     |                                           |
| Average Diagnostic Coverage (DC <sub>avg</sub> ) (as per ISO 13849-1)                                   | ≥99 %                                                                                     |                                           |
| Maximum number of cycles over lifetime                                                                  | DC-13                                                                                     | 24V DC 1 A: 1200000<br>24V DC 3 A: 275000 |
|                                                                                                         | AC-1                                                                                      | 250V AC 4 A: 90000                        |
|                                                                                                         | AC-15                                                                                     | 250V AC 1 A: 90000                        |
|                                                                                                         |                                                                                           | 250 VAC 5 A: 60000                        |

For other specifications (common to all models), see page 25.

## HR6S-EP

### Wiring Example (When connecting to HR6S-AF)



| Designation | Explanation             |
|-------------|-------------------------|
| S1          | Emergency stop switch   |
| S2          | Start switch            |
| K3 to K6    | Contactor               |
| PLC         | Programmable controller |
| F1 to F4    | Fuse                    |



## Common Specifications

## Applicable Standards

|                      |                                                                                                                                                                  |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Applicable Standards | IEC 61508:2010<br>IEC 62061:2015<br>ISO 13849-1:2015<br>IEC 60947-5-1:2016<br>IEC 60947-1:2007<br>UL60947-5-1<br>CAN/CSA C22.2 No. 60947-5-1<br>GB/T14048.5-2017 |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## Environmental Characteristics for Operation

|                                                                               |         |
|-------------------------------------------------------------------------------|---------|
| Maximum installation altitude above mean sea level                            | 2,000 m |
| Installation required in control cabinet/ enclosure with degree of protection | IP54    |

The device complies with class 3K5 and special class 3Z11 as per IEC 60721-3-3 (climatic conditions):

|                            |                                                                            |
|----------------------------|----------------------------------------------------------------------------|
| Ambient temperature        | -25 to +55 °C (no freezing)                                                |
| HR6S-DN                    | 24 VAC: -25 to +50 °C (no freezing)<br>24V DC: -25 to +55 °C (no freezing) |
| Temperature variation rate | 0.5 °C/min                                                                 |
| Ambient humidity           | 5 to 95 % relative humidity (no condensation)                              |

The device complies with class 3M4 as per IEC 60721-3-3 (mechanical conditions):

|                                                           |                      |
|-----------------------------------------------------------|----------------------|
| Vibration, sinusoidal, displacement amplitude 2 to 9 Hz   | 3 mm                 |
| Vibration, sinusoidal, acceleration amplitude 9 to 200 Hz | 10 m/s <sup>2</sup>  |
| Shock, shock pulse shape: half-sine, peak acceleration    | 100 m/s <sup>2</sup> |

The device complies with the following vibration and shock values as per IEC 60947-1:

|                                                              |                      |
|--------------------------------------------------------------|----------------------|
| Vibration, sinusoidal, displacement amplitude 2 to 13 Hz     | 1 mm                 |
| Vibration, sinusoidal, acceleration amplitude 13.2 to 100 Hz | 7 m/s <sup>2</sup>   |
| Shock, shock pulse shape: half-sine, peak acceleration       | 150 m/s <sup>2</sup> |

## Environmental Characteristics for Storage

The device complies with class 1K5 as per IEC 60721-3-1 (climatic conditions):

|                     |                                                |
|---------------------|------------------------------------------------|
| Ambient temperature | -40 to 70 °C, no freezing                      |
| Ambient humidity    | 10 to 100 % relative humidity, no condensation |

The device complies with class 2M2 as per IEC 60721-3-2 (mechanical conditions):

|                                                           |                     |
|-----------------------------------------------------------|---------------------|
| Vibration, sinusoidal, displacement amplitude 2 to 9 Hz   | 1.5 mm              |
| Vibration, sinusoidal, acceleration amplitude 9 to 200 Hz | 5 m/s <sup>2</sup>  |
| Shock, shock response spectrum type L, peak acceleration  | 40 m/s <sup>2</sup> |

## Electrical Data

|                                                      |                                                                                                                                                                              |
|------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Supply voltage                                       | 24V AC -15 to 10 % 50 to 60 Hz<br>24V DC -20 to 20 %                                                                                                                         |
| Nominal input power                                  | HR6S-AB / EP 3.5 VA (24V AC), 1.5 W (24V DC)<br>HR6S-AF / AK 5 VA (24V AC), 2 W (24V DC)<br>HR6S-AT 6.5 VA (24V AC), 3 W (24V DC)<br>HR6S-DN 10.5 VA (24V AC), 4.5W (24V DC) |
| Overvoltage category                                 | II                                                                                                                                                                           |
| Pollution degree                                     | 2                                                                                                                                                                            |
| Insulation voltage                                   | 300 V                                                                                                                                                                        |
| Impulse withstand voltage                            | 4 kV                                                                                                                                                                         |
| Conducted and radiated emissions as per IEC CISPR 11 | Group 1 / Class B                                                                                                                                                            |
| Usage in environment as per IEC/UL 60947-1           | Environment B                                                                                                                                                                |

## Wire Cross Sections, Stripping Lengths, and Tightening Torques

|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Stripping length for Push-in terminals | 12 mm                                                                                                                                                                                                                                                                                                                                                                                                               |
| Stripping length for screw terminals   | 7 to 8 mm                                                                                                                                                                                                                                                                                                                                                                                                           |
| Wire cross section                     | Single wire without wire ferrule (*1) 0.2 to 2.5 mm <sup>2</sup> (24 to 12 AWG)<br>Single wire with wire ferrule 0.25 to 2.5 mm <sup>2</sup> (24 to 12 AWG)<br>Two wires without wire ferrule (*1) 0.2 to 1.5 mm <sup>2</sup> (24 to 16 AWG)<br>Two wires with uninsulated wire ferrule 0.25 to 1 mm <sup>2</sup> (24 to 18 AWG)<br>Two wires with insulated wire ferrule 0.5 to 1.5 mm <sup>2</sup> (20 to 16 AWG) |
| Tightening torque for screw terminals  | 0.5 to 0.6 N m                                                                                                                                                                                                                                                                                                                                                                                                      |

\*1: Stranded or solid

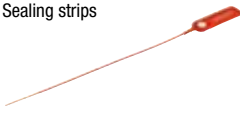
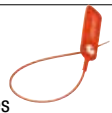
## Timing Data

|                                                                         |                                                     |
|-------------------------------------------------------------------------|-----------------------------------------------------|
| Maximum response time to request at safety-related input                | 20 ms                                               |
| Maximum response time after power outage AC                             | 140 ms (HR6S-EP)<br>200 ms                          |
| Maximum response time after power outage DC                             | 100 ms (HR6S-EP)<br>120 ms<br>140 ms (HR6S-DN / AT) |
| Recovery time after request at safety-related input                     | 200 ms                                              |
| Switch on delay after power on and automatic start                      | 2500 ms<br>3000 ms (HR6S-DN)                        |
| Delay after activation of safety-related input or valid start condition | 100 ms                                              |
| Delay after power on and monitored start                                | 2500 ms<br>3000 ms (HR6S-DN)                        |
| Minimum duration of start pulse for monitored start                     | 80 ms                                               |
| Debounce time, standard                                                 | 2.5 ms                                              |
| Debounce time, with OSSD                                                | 4 ms                                                |
| Signal interlock monitoring time                                        | 200 ms                                              |

## Dynamization of Safety-Related Inputs and Start Input (except HR6S-EP)

|                                                                                                     |                             |
|-----------------------------------------------------------------------------------------------------|-----------------------------|
| Test pulse duration (safety-related input must be activated for longer than duration of test pulse) | 2 ms                        |
| Test pulse interval                                                                                 | 500 ms<br>1000 ms (HR6S-DN) |
| Maximum delay of test pulse                                                                         | 40 ms                       |
| Test pulse phase shift                                                                              | At least 70 ms              |

## Accessories

| Name / Appearance                                                                                   | Part No. | Package Quantity | Remarks                                                                                                                                                                                                                                                                                                                                             |
|-----------------------------------------------------------------------------------------------------|----------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Coding bits<br>    | HR9Z-EC  | 30               | Red plastic parts mounts on the four grooves on the terminal block, and yellow resin parts mounts in the grooves in the same position on the main unit. The terminal block cannot be inserted if the plastic parts collide with each other, so by changing the mounting position for each terminal, insertion into the wrong position is prevented. |
| Sealing strips<br> | HR9Z-ES  | 10               | 1 sealing strip is included.<br>Used to lock the front transparent cover to prevent dial setting changes.<br>Printed with a 10 digit serial number for management purposes<br>                                                                                   |

## DIN Rails

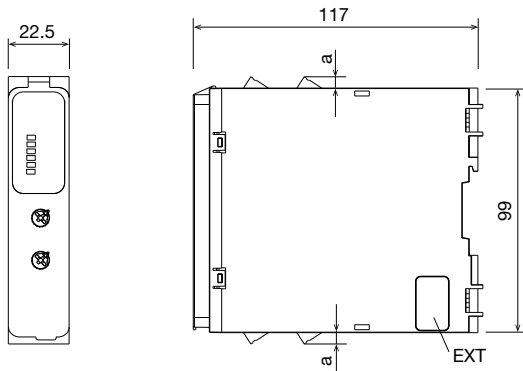
When ordering, specify the Ordering No..

| Name / Appearance | Part No. | Ordering No. | Package Quantity | Remarks                                                                          |
|-------------------|----------|--------------|------------------|----------------------------------------------------------------------------------|
| DIN 35 mm rails   | BAA1000  | BAA1000PN10  | 10               | Aluminum<br>Length: 1000 mm<br>Weight (approx.): 200 g                           |
| End clips         | BNL6     | BNL6PN10     | 10               | Metal (zinc-plated steel)<br>Weight (approx.): 15 g<br>Compatible rails: BAA1000 |

## Dimensions

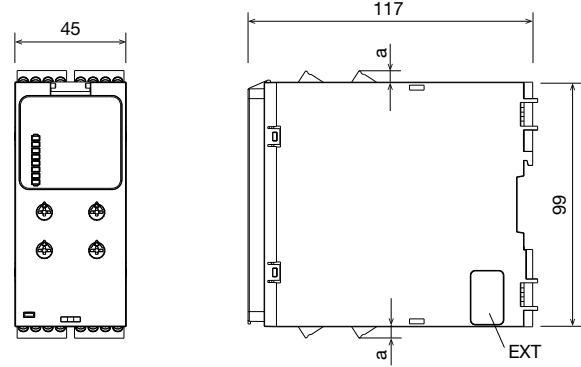
(Dimensions in mm.)

HR6S-AF, HR6S-AK, HR6S-S



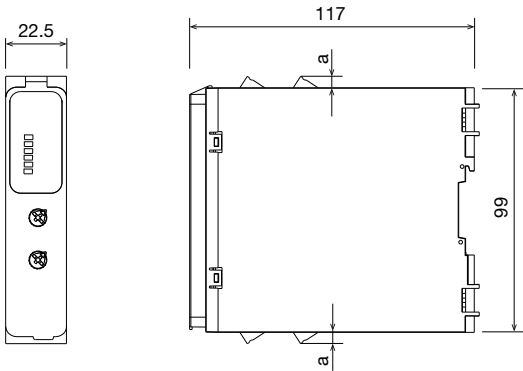
Weight: 200 g

HR6S-AT



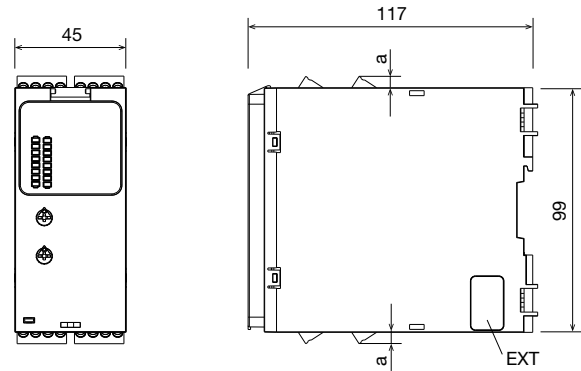
Weight: 350 g

HR6S-AB



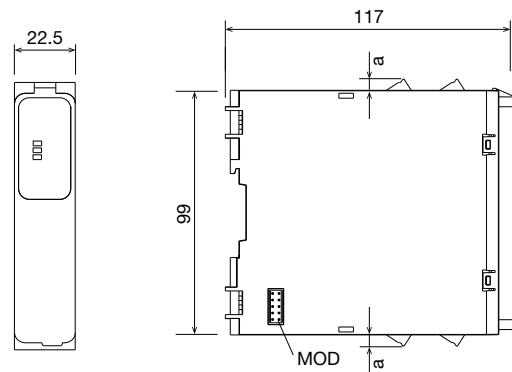
Weight: 200 g

HR6S-DN



Weight: 350 g

HR6S-EP



Weight: 200 g

| Designation | Explanation                                     |
|-------------|-------------------------------------------------|
| a           | Push-in terminal: 10 mm<br>Screw terminal: 5 mm |
| EXT         | Connector for output expansion module (side)    |
| MOD         | Connector for base safety module                |

- The maximum dimensions when the front transparent cover is opened are 154 mm in height and 202 mm in depth.

## LED Display (Example for HR6S-AT)

| LED         | State | Explanation                                                     |
|-------------|-------|-----------------------------------------------------------------|
| POWER       | ○     | Power supply on                                                 |
|             | ●     | No power supply                                                 |
| Snn         | ○     | Safety-related input activated                                  |
|             | ●     | Safety-related input deactivated                                |
| START       | ○     | Valid start condition                                           |
|             | ●     | No valid start condition                                        |
|             | ○ ●   | Waiting for valid start condition                               |
| STATEn (*3) | ○     | Normally open safety-related outputs activated                  |
|             | ●     | Normally open safety-related outputs deactivated                |
| ERROR       | ○ ●   | Synchronization time alert<br>Other LEDs retain normal behavior |
| Snn (*1)    | ○ ●   |                                                                 |
| Snn (*1)    | ○ ●   |                                                                 |
| ERROR       | ○ ●   | Interlock alert<br>Other LEDs retain normal behavior            |
| Snn (*2)    | ○ ●   |                                                                 |
| Snn (*2)    | ○ ●   |                                                                 |
| ERROR       | ○     | General error detected<br>Module in defined safe state          |
| LEDs (*4)   | ○ ●   |                                                                 |
| ERROR       | ○     | Configuration error detected                                    |
| LEDs (*4)   | ○     |                                                                 |
| ERROR       | ○     | Power supply error detected                                     |
| POWER       | ○ ●   |                                                                 |

| LED         | State | Explanation                                                 |
|-------------|-------|-------------------------------------------------------------|
| ERROR       | ○     | Cross circuit detected at safety-related input              |
| Snn (*2)    | ○ ●   |                                                             |
| Snn (*2)    | ○ ●   |                                                             |
| ERROR       | ○     | Cross circuit detected at Start input                       |
| START       | ○ ●   |                                                             |
| ERROR       | ○     | Error detected at safety-related output                     |
| STATEn (*3) | ○ ●   |                                                             |
| ERROR       | ○     | Error detected at safety-related output of expansion module |
| START       | ○ ●   |                                                             |
| STATEn (*3) | ○ ●   |                                                             |
| LEDs        | ○     | All LEDs light up during power-up for diagnostics purposes. |

○ : LED solid on

● : LED off

○ ● : LED flashing

\*1: Snn: n = number off LED of affected input, LEDs flashing alternately

\*2: Snn: n = number off LED of affected input, LEDs flashing synchronously

\*3: STATEn: n = 1 = Instantaneous  
n = 2 = Delay

\*4: LEDs: All LEDs except POWER

\* For details, refer to the instruction sheet.

## Start Function Selector (Common to All Types)

| Selector Position | Start Function              | Startup Test (*3) | Dynamization (*8) |
|-------------------|-----------------------------|-------------------|-------------------|
| 1                 | Manual/automatic start (*5) | No                | Yes               |
| 2                 | Manual/automatic start (*5) | Yes               | Yes               |
| 3                 | Monitored start (*6)        | No                | Yes               |
| 4                 | Monitored start (*2)        | Yes               | Yes               |
| 5                 | Manual/automatic start (*1) | No                | No                |
| 6                 | Manual/automatic start (*1) | Yes               | No                |
| 7                 | Monitored start (*2)        | No                | No                |
| 8                 | Monitored start (*2)        | Yes               | No                |

\*5) Automatic start when short-circuit occurs.

\*6) Falling edge. The safety-related input must be activated for a period of at least 80 ms.

\*7) Startup test: The safety-related input must be disabled and then re-enabled before the safety-related output can be turned on. Normally, it is used to monitor guards. Even if the automatic start mode is selected, the guard must be opened and closed once after turning on the power.

\*8) HR6S checks the pulse of Y1 to detect short-circuit between other input wires and power supply wires, so when 24V signals are input to Y2 from PLCs, select start mode when dynamization is "No".

## Status Monitor by Diagnosis (Example for HR6S-AT)

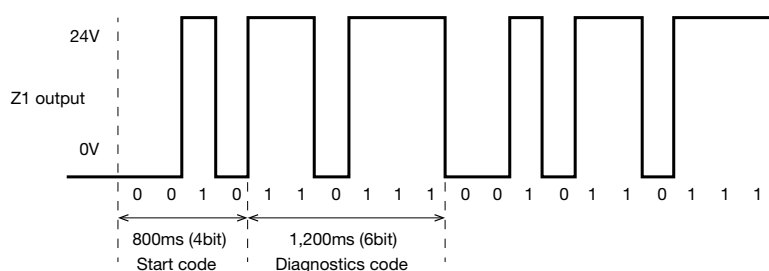
## Explanation of Status Output

The HR6S diagnoses and monitors connected devices, and can output the results to the Tr output (not safety-related).

The status monitor outputs a pulse signal instead of I/O.

The length of the diagnostic bit sequence output from status output Z1 is 2 s. The configuration is a 10-bit signal where each bit is 200 ms. The first 4 bits (0010) are the start codes that represent the start of the bit sequence. The next 6 bits are a diagnostics code that indicates the status of the HR6S.

The cycle time (scan time) of the task that executes the program must be 50 ms or less for the bit sequence to be detected correctly. A ladder program for decoding by PLC is provided. (For IDEC FC6A PLC)



Note 1: If the status of the HR6S changes during the output of the bit sequence, it will be sent in the next sequence. Therefore, the maximum delay in status output for a change of status is 4 s.

However, if the running bit sequence does not last until the next sequence starts (if status changes occur within 2 s), it will not be sent in the next sequence.

Note 2: Turning off the power connected to the HR6S safety module can cause the ladder program to detect incorrect status information.

## Diagnostics Codes

| Bit sequence | Description                                                                                                                                  | Correctives                                                                                                                                                                                                                                                                                                                                                          | Type (*1) |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 0010101101   | Supply voltage out of tolerance.                                                                                                             | Verify correct wiring.<br>Use a suitable power supply.                                                                                                                                                                                                                                                                                                               | E         |
| 0010000011   | General error detected.                                                                                                                      | Verify correct wiring.<br>Perform a power cycle.<br>If the error persists, replace the device.                                                                                                                                                                                                                                                                       | E         |
| 0010000110   | Configuration error detected with the expansion module. The position of at least one of the selectors has been modified during operation.    | Verify correct wiring.<br>Turn on the power to this product and the connected expansion module again.<br>If the error persists, replace the expansion module.                                                                                                                                                                                                        | E         |
| 0010000111   | Synchronization alert.<br>Both synchronized safety-related inputs have been activated, but not within the synchronization time.              | Verify that the position of the selectors is appropriate for the application to be implemented.<br>Perform a power cycle.<br>If the error persists, replace the device.                                                                                                                                                                                              | E         |
| 0010001100   | Cross circuit detected at input terminal S12.                                                                                                | Verify correct wiring.<br>Verify that the sensor/device providing the input signal is suitable for cross circuit detection by means of dynamization. If it is not, use an application function without dynamization or a sensor/device suitable for dynamization.<br>Verify correct operation of sensor/device providing the input signal.<br>Perform a power cycle. | E         |
| 0010001111   | Cross circuit detected at input terminal S22.                                                                                                | Verify correct wiring.<br>Verify that the sensor/device providing the input signal is suitable for cross circuit detection by means of dynamization. If it is not, use an application function without dynamization or a sensor/device suitable for dynamization.<br>Verify correct operation of sensor/device providing the input signal.<br>Perform a power cycle. | E         |
| 0010011000   | Cross circuit detected at input terminal S32.                                                                                                | Verify correct wiring.<br>Verify that the sensor/device providing the input signal is suitable for cross circuit detection by means of dynamization. If it is not, use an application function without dynamization or a sensor/device suitable for dynamization.<br>Verify correct operation of sensor/device providing the input signal.<br>Perform a power cycle. | E         |
| 0010110000   | A cross circuit has been detected at the start input.                                                                                        | Verify correct wiring.<br>Verify that the sensor/device providing the input signal is suitable for cross circuit detection by means of dynamization. If it is not, use an application function without dynamization or a sensor/device suitable for dynamization.<br>Verify correct operation of sensor/device providing the input signal.<br>Perform a power cycle. | E         |
| 0010100011   | A cross circuit has been detected at the input used for the delay cancel function.                                                           | Verify correct wiring.<br>Verify that the sensor/device providing the input signal is suitable for cross circuit detection by means of dynamization. If it is not, use an application function without dynamization or a sensor/device suitable for dynamization.<br>Verify correct operation of sensor/device providing the input signal.<br>Perform a power cycle. | E         |
| 0010110011   | Synchronization alert. One of the synchronized safety-related inputs is still deactivated, but the synchronization time has already elapsed. | Please restore the input state and try again.<br>Verify correct operation of sensor/device providing the input signal.                                                                                                                                                                                                                                               | A         |
| 0010100111   | Synchronization alert. Both synchronized safety-related inputs have been activated, but not within the synchronization time.                 | Please restore the input state and try again.<br>Verify correct operation of sensor/device providing the input signal.                                                                                                                                                                                                                                               | A         |

\*1) Message type: E = Error detected, A = Alert

| Bit sequence | Description                                                                                                                                   | Type (*2) |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 0010110110   | Instantaneous safety-related outputs are deactivated, and delay safety-related outputs remain activated.                                      | S         |
| 0010110111   | Both safety-related inputs and safety-related outputs are deactivated.                                                                        | S         |
| 0010110101   | Waiting for the state of input S12 to change.<br>If this setting is by antivalent input, waits for the state of inputs S12 and S13 to change. | S         |
| 0010111100   | Waiting for the state of input S22 to change.<br>If this setting is by antivalent input, waits for the state of inputs S22 and S23 to change. | S         |
| 0010111111   | Waiting for the state of input S32 to change.<br>If this setting is by antivalent input, waits for the state of inputs S32 and S33 to change. | S         |
| 0010101011   | Waiting for startup test.                                                                                                                     | S         |
| 0010101010   | Waiting for rising edge for automatic/manual start or monitored start.                                                                        | S         |
| 0010101110   | Valid start condition. Waiting for the falling edge for a monitored start.                                                                    | S         |
| 0010101111   | The operating status of this product is "Operating: Output is on", and safety-related outputs are activated.                                  | S         |

\*2) Message type: S = Status information

## Safety Systems

- Perform operations, adjustments, and maintenance according to the standards applicable to the electric machine.
- For input devices and output devices for safety control that are connected to this product, use products that comply with the standards that are required to meet the requirements for ISO13849-1 safety systems.

## ⚠ Safety Precautions

- Do not disassemble, repair, or modify the product. This may cause impairment of the safe operability of the safety relay module.
- This product is not intended for use in applications that require a high degree of safety and reliability, such as nuclear power, railways, aviation, and passenger equipment. Do not use this product for such applications.
- Turn off the power to the product before starting installation, removing, wiring, maintenance, or inspection of the safety relay module. Failure to turn power off may cause electric shocks or fire hazard.
- Be sure to read the instructions attached to the product or website and use under the appropriate environment. Insufficient installation may lead to damage or failure.
- Make sure to take measures to prevent electric shock due to insulation damage between outputs.
- Use within the specified voltage. Do not use a power supply that produce high ripple voltage or abnormal voltage.
- Use a power supply that meets following required specifications;
  - Complies with SELV or PELV circuit specified by IEC 60364-4-41.
  - Has the functionality of the control voltage and current of class 2 circuit, as defined in UL508.
- Check the safety function of the product periodically, turn OFF the signal to the safety input (e.g. at least once a year) and make sure the safety outputs turn OFF.
- The product is designed for installation within an enclosure. Do not install the product outside an enclosure. Install the product in an enclosure rated IP54 or higher.
- Install the product in environments described in this instruction sheet. If the safety relay module is used in places where the product is subjected to high temperature, high humidity, condensation, corrosive gases, excessive vibrations, and excessive shocks then electric shocks, fire hazard, or malfunction may result.
- Environment for using the product is "Pollution degree 2". Use the safety relay module under pollution degree 2 environment.
- When disposing the product, follow the laws and regulations of the country where it is disposed.

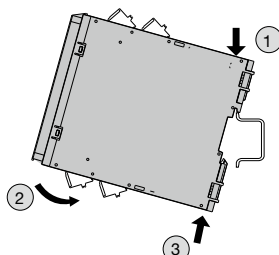
## Installation/Removal

### DIN Rails (BAA1000 (Sold separately: See page 26.))

HR6S can be mounted on the below DIN rails that comply with IEC 60715.  
35 x 15 mm, 35 x 7.5 mm

#### • Installation procedure

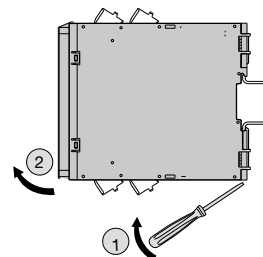
- (1) Tilt the product slightly and hook on to the DIN rail.
- (2) Push the bottom of the product towards the DIN rail.
- (3) Push until the product is securely attached to the clip on the DIN rail.



- The wiring diagrams shown in this catalog are only examples. To ensure that your safety system meets a suitable performance level, please conduct a risk assessment and consult with a third-party certification body.

#### • Removal procedure

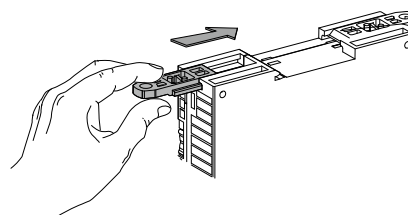
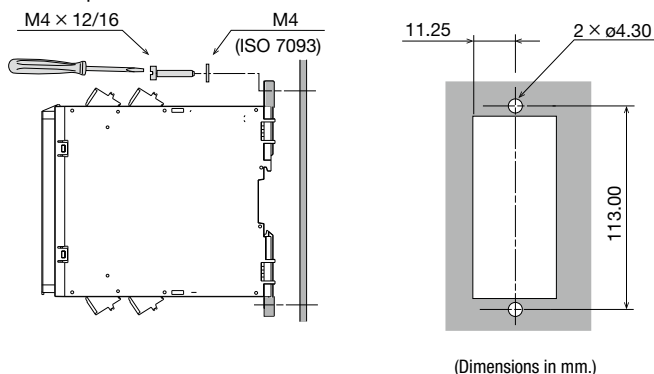
- (1) Use a screwdriver to release the clip on the DIN rail.
- (2) Pull the bottom of the product away from the DIN rail, and then lift the product upward to remove it from the DIN rail.



## Mounting with screws

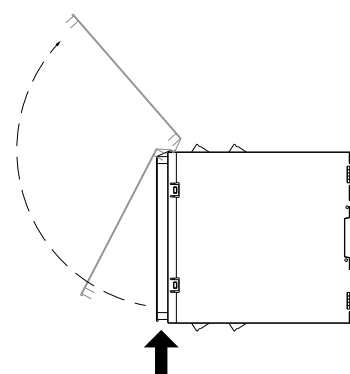
#### • Installation procedure

- (1) Push the included fastener into the groove on the product.
- (2) Make holes in the surface of the panel where the product will be mounted.
- (3) Use the specified screws and ISO 7093 compliant M4 washers to mount the product on the installation surface.



## Opening the Transparent Cover

Press in the hook (indicated by the arrow) with fingernail, and then lift the transparent cover.





## ⚠ Safety Precautions

### Wiring Procedure

#### Insert

- (1) Insert the solid wire or stranded wire with ferrule into the terminal entrance.
  - (2) After wiring, tug lightly to make sure that the wire is properly connected.
- \*When inserting stranded wires directly, make sure that the pusher is pressed down and there are no loose wires.



#### Remove

- (1) Press the pusher using a flat screwdriver.
- (2) Remove the wire by pressing the pusher.



- For details on wire cross sections, stripping lengths, and tightening torques, see page 25.

## Category 2 Safety Relay Module HR5S



### Safety measures for low risk machines

## Category 2 Safety Relay Module

### Introducing a safety system for low risk machines

Designing a category 2 system has been difficult and only a redundant system (category 3) could be used to protect machines against relatively minor hazards.

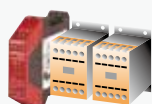
However, with the HR5S safety relay module, designing a category 2 system is easy and enables cost reduction and saves maintenance time.

See IDEC website for more details.

### Performance of Category 2 system

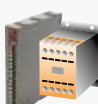
System that eliminates short-circuit fault detection when wiring from an input device

HR1S-AF



Total width  
**41% DOWN**  
Cost  
**45% DOWN**

HR5S-C2S



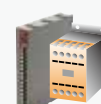
System with off-delay control system

HR1S-ATE



Total width  
**52% DOWN**  
Cost  
**39% DOWN**

HR5S-C2D



## Ordering Terms and Conditions

Thank you for using IDEC Products.

By purchasing products listed in our catalogs, datasheets, and the like (hereinafter referred to as "Catalogs") you agree to be bound by these terms and conditions. Please read and agree to the terms and conditions before placing your order.

### 1. Notes on contents of Catalogs

- (1) Rated values, performance values, and specification values of IDEC products listed in this Catalog are values acquired under respective conditions in independent testing, and do not guarantee values gained in combined conditions.  
Also, durability varies depending on the usage environment and usage conditions.
- (2) Reference data and reference values listed in Catalogs are for reference purposes only, and do not guarantee that the product will always operate appropriately in that range.
- (3) The specifications / appearance and accessories of IDEC products listed in Catalogs are subject to change or termination of sales without notice, for improvement or other reasons.
- (4) The content of Catalogs is subject to change without notice.

### 2. Note on applications

- (1) If using IDEC products in combination with other products, confirm the applicable laws / regulations and standards.  
Also, confirm that IDEC products are compatible with your systems, machines, devices, and the like by using under the actual conditions. IDEC shall bear no liability whatsoever regarding the compatibility with IDEC products.
- (2) The usage examples and application examples listed in Catalogs are for reference purposes only. Therefore, when introducing a product, confirm the performance and safety of the instruments, devices, and the like before use. Furthermore, regarding these examples, IDEC does not grant license to use IDEC products to you, and IDEC offers no warranties regarding the ownership of intellectual property rights or non-infringement upon the intellectual property rights of third parties.
- (3) When using IDEC products, be cautious when implementing the following.
  - i. Use of IDEC products with sufficient allowance for rating and performance
  - ii. Safety design, including redundant design and malfunction prevention design that prevents other danger and damage even in the event that an IDEC product fails
  - iii. Wiring and installation that ensures the IDEC product used in your system, machine, device, or the like can perform and function according to its specifications
- (4) Continuing to use an IDEC product even after the performance has deteriorated can result in abnormal heat, smoke, fires, and the like due to insulation deterioration or the like. Perform periodic maintenance for IDEC products and the systems, machines, devices, and the like in which they are used.
- (5) IDEC products are developed and manufactured as general-purpose products for general industrial products. They are not intended for use in the following applications, and in the event that you use an IDEC product for these applications, unless otherwise agreed upon between you and IDEC, IDEC shall provide no guarantees whatsoever regarding IDEC products.
  - i. Use in applications that require a high degree of safety, including nuclear power control equipment, transportation equipment (railroads / airplanes / ships / vehicles / vehicle instruments, etc.), equipment for use in outer space, elevating equipment, medical instruments, safety devices, or any other equipment, instruments, or the like that could endanger life or human health
  - ii. Use in applications that require a high degree of reliability, such as provision systems for gas / waterworks / electricity, etc., systems that operate continuously for 24 hours, and settlement systems
  - iii. Use in applications where the product may be handled or used deviating from the specifications or conditions / environment listed in the Catalogs, such as equipment used outdoors or applications in environments subject to chemical pollution or electromagnetic interference  
If you would like to use IDEC products in the above applications, be sure to consult with an IDEC sales representative.

### 3. Inspections

We ask that you implement inspections for IDEC products you purchase without delay, as well as thoroughly keep in mind management/maintenance regarding handling of the product before and during the inspection.

### 4. Warranty

#### (1) Warranty period

The warranty period for IDEC products shall be one (1) year after purchase or delivery to the specified location. However, this shall not apply in cases where there is a different specification in the Catalogs or there is another agreement in place between you and IDEC.

#### (2) Warranty scope

Should a failure occur in an IDEC product during the above warranty period for reasons attributable to IDEC, then IDEC shall replace or repair that product, free of charge, at the purchase location / delivery location of the product, or an IDEC service base. However, failures caused by the following reasons shall be deemed outside the scope of this warranty.

- i. The product was handled or used deviating from the conditions / environment listed in the Catalogs
- ii. The failure was caused by reasons other than an IDEC product
- iii. Modification or repair was performed by a party other than IDEC
- iv. The failure was caused by a software program of a party other than IDEC
- v. The product was used outside of its original purpose
- vi. Replacement of maintenance parts, installation of accessories, or the like was not performed properly in accordance with the user's manual and Catalogs
- vii. The failure could not have been predicted with the scientific and technical standards at the time when the product was shipped from IDEC.
- viii. The failure was due to other causes not attributable to IDEC (including cases of force majeure such as natural disasters and other disasters)

Furthermore, the warranty described here refers to a warranty on the IDEC product as a unit, and damages induced by the failure of an IDEC product are excluded from this warranty.

### 5. Limitation of liability

The warranty listed in this Agreement is the full and complete warranty for IDEC products, and IDEC shall bear no liability whatsoever regarding special damages, indirect damages, incidental damages, or passive damages that occurred due to an IDEC product.

### 6. Service scope

The prices of IDEC products do not include the cost of services, such as dispatching technicians. Therefore, separate fees are required in the following cases.

- (1) Instructions for installation / adjustment and accompaniment at test operation (including creating application software and testing operation, etc.)
- (2) Maintenance inspections, adjustments, and repairs
- (3) Technical instructions and technical training
- (4) Product tests or inspections specified by you

The above content assumes transactions and usage within your region. Please consult with an IDEC sales representative regarding transactions and usage outside of your region. Also, IDEC provides no guarantees whatsoever regarding IDEC products sold outside your region.

# IDEC CORPORATION

#### Head Office

6-64, Nishi-Miyahara-2-Chome, Yodogawa-ku, Osaka 532-0004, Japan

|                  |                                     |                        |                      |                  |                             |                       |                       |
|------------------|-------------------------------------|------------------------|----------------------|------------------|-----------------------------|-----------------------|-----------------------|
| <b>USA</b>       | IDEC Corporation                    | Tel: +1-408-747-0550   | opencontact@idec.com | <b>Taiwan</b>    | IDEC Taiwan Corporation     | Tel: +886-2-2577-6938 | service@tw.idec.com   |
| <b>Germany</b>   | APEM GmbH                           | Tel: +49-40-25 30 54-0 | service@eu.idec.com  | <b>Hong Kong</b> | IDEC Izumi (H.K.) Co., Ltd. | Tel: +852-2803-8989   | info@hk.idec.com      |
| <b>Singapore</b> | IDEC Izumi Asia Pte. Ltd.           | Tel: +65-6746-1155     | info@sg.idec.com     | <b>China</b>     | IDEC (Shanghai) Corporation | Tel: +86-21-6135-1515 | idec@cn.idec.com      |
| <b>Thailand</b>  | IDEC Asia (Thailand) Co., Ltd.      | Tel: +66-2-392-9765    | sales@th.idec.com    |                  | Beijing Branch              | Tel: +86-10-6581-6131 | idec@cn.idec.com      |
| <b>Australia</b> | IDEC Australia Pty. Ltd.            | Tel: +61-3-8523-5900   | sales@au.idec.com    |                  | Guangzhou Branch            | Tel: +86-20-8362-2394 | idec@cn.idec.com      |
| <b>India</b>     | IDEC Controls India Private Limited | Tel: +91-80679-35328   | info_india@idec.com  | <b>Japan</b>     | IDEC Corporation            | Tel: +81-6-6398-2527  | jp_marketing@idec.com |

 **www.idec.com**