8.7 DO760

8.7.1 General Information

The DO760 is a standard digital output module. The outputs are single channel isolated.

8.7.2 Order Data

Model Number	Short Description	Image
3DO760.6	2005 Digital Output Module, 8 relay outputs 240 VAC / 30 VDC, 4 A, outputs electrically isolated. Order TB170 terminal block separately.	
3TB170.9	2005 terminal block, 20-pin, screw clamps	
3TB170.91	2005 terminal block, 20-pin, cage clamps	
3TB170:90-02	2005 terminal block, 20-pin, 20 pcs., screw clamps	
3TB170:91-02	2005 terminal block, 20-pin, 20 pcs., cage clamps	
Terminal blocks not included in the delivery (see "Accessories").		

Table 163: DO760 order data

8.7.3 Technical Data

Product ID	DO760
General Information	
C-UL-US Listed	Yes
B&R ID Code	$B0

Can be Installed on
    Main Rack
    Expansion Rack
	
	Yes
	Yes

Static Characteristics	
Module Type	B&R 2005 I/O module
Number and Type of Outputs	4 change over contacts 4 normally open contacts The outputs are single channel isolated.
Maximum Switching Voltage	125 VDC / 264 VAC
Maximum Peak Voltage	Externally limited to a maximum of 460 V
Rated Voltage	30 VDC / 240 VAC
Switching Voltage Range	min. 5 VDC @ 1 mA
Rated Frequency	DC or 45 - 63 Hz
Rated Current (1-Signal)I_e	4 A (resistive load)

Current Range at 1-Signal (continuous at maximum voltage)
    DC
    AC
	
	1 mA - 4 A (resistive load)
	100 mA -8 A (resistive load)

Switching Capacity	2000 VA; 120 W @ 30 VDC (resistive load)
Contact Resistance (DC)	Max. 100 mΩ @ 6 VDC / 100 mA
Power Loss on Contact (AC)	Typical 1 W (max. 5 W)
Fuse	External Fuse
Wiring	4 change-over contacts / 4 normally open contacts

Power Consumption
   Internal
      5 V
      24 V
      Total
   External
	
	Max. 4 W
	--- 	
	Max. 4 W
	Max. 4 W

Additional Characteristics	
Status Display	1 yellow LED per channel
Protection Characteristics	

Type of Protection
   Short Circuit Protection
      AC
      DC
   Overvoltage Protection for Contacts
   DC Connection
	
	Fuse 8 A time lag (required externally)
	Fuse 4 A time lag (required externally)
	Limited to 460 V (required externally)
	Spark protection as required (to be connected externally)

Table 164: DO760 technical data

Product ID	DO760
Dynamic Characteristics	

Output Delay for Signal Changes from
   log 0 - log 1
   log 1 - log 0
	Max. 13 ms (including chatter time)
	Max. 16 ms (including chatter time)

Operating Characteristics	
Consequences when Outputs Incorrectly Connected	No effects on the module
Output Behavior when the Controller Falls Out During Voltage Dips, Interruptions and when the Unit is Switched On-or Off	The outputs are reset in the event of malfunction (normally closed)
Relay Contact Lifespan	See Section 8.7.8 "Switching Cycles", on page 289

Total Output Current
   Following Condition must be Fulfilled
 	
   Wire Cross Section
	Max. 32 A
	$\Sigma\, I_n^2 \leq 200$
	See alsoSection 8.7.7 "Total Output Current Allowed", on page 288
	2.5 mm², for currents$\geq$4 A or if a recommended value is reached

Isolation Voltage under Normal Operating Conditions between Channel and
   Bus
   Other Channels
   Supply Interfaces
	
	1 Minute 2800 VAC or 4 kV @ 1.2 x 50 µs pulse
	1 Minute 1000 VAC or 1.4 kV @ 1.2 x 50 µs pulse
	--- 	

Isolation Strength between Open Relay Contacts	1 Minute 1000 VAC or 1.4 kV @ 1.2 x 50 µs pulse
Different Phases Possible	Yes, but only for 110 VAC
Point at which the LED for Each Channel is Switched On	When a relay coil signal is received
Method of Operation	Latches are written using the bus, which are switched via the relay's transistor driver
Typical Example for External Connections	Standard N.O. and changeover circuit, Sink and source connection possible
Mechanical Characteristics	
Dimensions	B&R 2005 single-width
Pin Assignments	See Section 8.7.5 "Pin Assignments", on page 286

Table 164: DO760 technical data (cont.)

8.7.4 Status LEDs

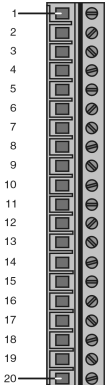| Image	LED	Description
	1 - 8	Status LEDs indicate the logic status of the corresponding output, also when the terminal block is not connected and there is no voltage to the terminal block. The LED is lit if the relay contact is made (N.O. contact closes, N.C. contact opens).

Table 165: DO760 status LEDs

8.7.5 Pin Assignments

	Connection	Assignment		
	1	Output 1	COM	
	2	Output 1	N.O.	
	3	Output 1	N.C.	
	4	Output 2	COM	
	5	Output 2	N.O.	Group 1
	6	Output 3	COM	
	7	Output 3	N.O.	
	8	Output 4	N.C.	
	9	Output 4	N.O.	
	10	Output 4	COM	
	11	Output 5	COM	
	12	Output 5	N.O.	
	13	Output 5	N.C.	
	14	Output 6	COM	
	15	Output 6	N.O.	Group 2
TB170	16	Output 7	COM	
	17	Output 7	N.O.	
	18	Output 8	N.C.	
	19	Output 8	N.O.	
	20	Output 8	COM	

Table 166: DO760 pin assignment

For the connection of the terminal block, it is important to ensure that any potential difference does not exceed 50 V. This is valid for:

Potential Difference Between	Voltage
COM x ↔ PLC Ground	250 VAC
COM ↔ Ground	250 VAC

Table 167: DO760 maximum potential difference not exceeded

8.7.6 Output Circuit Diagram

Change-over Contact
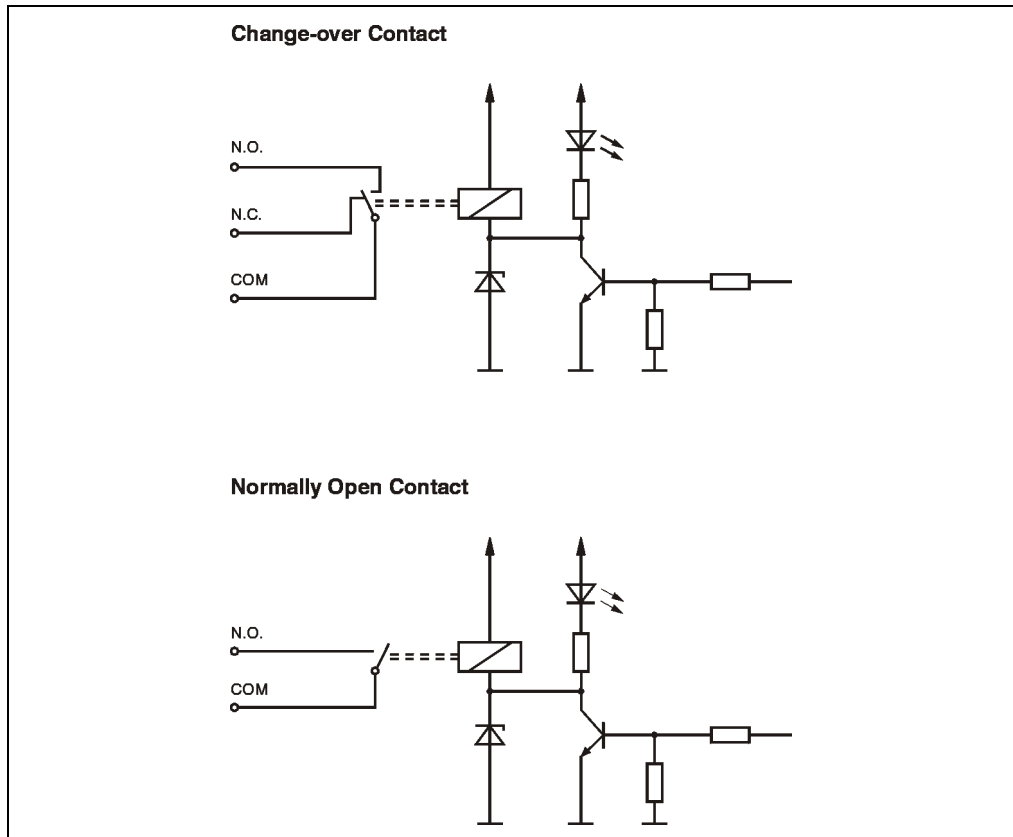
Normally Open Contact

Figure 111: DO760 output circuit diagram

8.7.7 Total Output Current Allowed

The DO760 digital output module is set up for a total output current of 32 A. The following conditions must be fulfilled to protect against the module overheating:

$$\Sigma\, I_n \leq 32\ A \quad\quad \text{and} \quad\quad \Sigma\, I_n{}^2 \leq 200$$

$$n \ldots \text{Channel number 1 to 8}$$

Wire Cross Section

For currents of ≥ 4 A or when one of the above recommended values has been reached, wires with a cross section of 2.5 mm² are required.

Calculation Example

Example 1

Each of the eight channels is loaded with 4 A.

1) Recommended Value 1: Total current ≤ 32 A

   $I_{total} = 8 \times 4\ A = 32\ A\ ->\ $ condition fulfilled

2) Recommended Value 2: $\Sigma\, I_n{}^2 \leq 200$

   $\Sigma\, I_n{}^2 = 8 \times 4^2 = 128\ ->\ $ condition fulfilled

Both conditions have been fulfilled. The load is therefore permitted. Wires with a cross section of 2.5 mm² are required.

Example 2

Three channels are supplied with a maximum current of 8 A.

1) Recommended Value 1: Total current ≤ 32 A

   $I_{total} = 3 \times 8\ A = 24\ A\ ->\ $ condition fulfilled

2) Recommended Value 2: $\Sigma\, I_n{}^2 \leq 200$

   $\Sigma\, I_n{}^2 = 3 \times 8^2 = 192$

Both conditions have been fulfilled. The load is therefore permitted. Wires with a cross section of 2.5 mm² are required.

8.7.8 Switching Cycles

Mechanical Load

The relay contacts are set up for 5×10^6 switching cycles.

Electrical Load

The following table contains an overview of switching cycles that can be carried out by the DO760 with various electromagnetic loads.

Valid for each specification:

- Maximum 30 switching cycles per minute
- Entries for N.O. and N.C., but not for change over contact. That means only N.O. or N.C. contacts are connected, but not both.

Load	Operating Cycles
Nominal load 8 A, 230 VAC, resistive	1×10^5
Motor load 230 VAC (starting current 12 A, cos φ 0.5, nominal current 1.8 A)	4×10^5
Valve load 0.1 A, 230 VAC	1×10^6
Hydraulic valve 2 A, 24 VDC (with external spark protection)	1×10^6
8 A, 30 VDC, resistive	>1000
1 A, 24 VDC	2×10^5

Table 168: DO760 electrical load

8.7.9 Variable Declarations

The variable declaration is made in B&R Automation Studio™:

Function	Variable Declarations				
	Scope	Data Type	Length	Module Type	Chan.
Single digital output (channel x)	tc_global	BOOL	1	Digit. Out	1 ... 8

Table 169: DO760 variable declaration