

EXD-U02 Universal Driver Module

Technical Bulletin

EXD-U02 is a Universal Driver Module that enables the operation of EMERSON stepper motor driven valves EX4-8, as well as the new series CV4-7 as:

- High pressure gas valve for flash tank
(**applies only to CV valves for CO₂**)
- Bypass valve from flash tank (**applies only to CV valves for CO₂**)
- Capacity control by means of hot gas bypass or evaporating pressure regulator
- Crankcase pressure regulator
- Heat reclaim regulator
- Liquid level regulator
- Direct replacement of EXD-U01, just dipswitch new setting required
(See table "Dip switch configuration")

Features

- 4...20 mA or 0...10 V analog input signal
- Step recovery function selectable
- Plug and run, no parameter setting i.e. automatic operation
- Easy configurable by Dip-switches
- Digital input for valve closure at any time
- Aluminum housing for DIN rail mounting

Emerson overcurrent built-in protection

EXD-U02 drivers offer an exclusive, built-in internal hardware that ensures the valve stepper motor is never bearing an overcurrent, so the current is modulated accordingly to optimize the valve best working conditions in the safest way.

Optional uninterruptible power supply ECP-024

The optional uninterruptible power supply ECP-024 contains a rechargeable lead-acid battery, which provides enough energy to close the valve in case of power loss. One single ECP-024 can be connected to two EXD-U02 driver modules for closure of up to two valves.



EXD-U02

Selection table

Type	Part No.	Description
EXD-U02	804752	Universal Driver Module without Terminal Kit
EXD-U02 Kit	808053	Universal Driver Module with Terminal Kit
K09-U00	804559	Terminal Kit for EXD-U...
ECP-024	804558	Uninterruptible power supply
K09-P00	804560	Electrical terminal kit for ECP-024



K09-U00



ECP-024



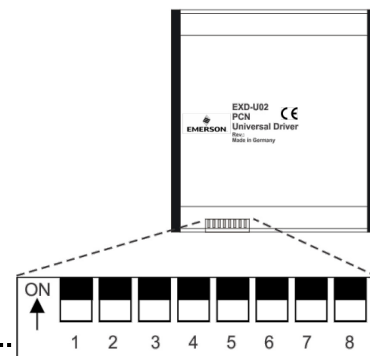
K09-P00

Dip switch configuration

The type of valve to be used, the enabling or disabling of the step recovery function, and the type of analogue input signal must be configured through the dipswitches, as shown below:

	Dip Switch Number							
Valve type/ recovery step /analogue input	1	2	3	4	5	6	7	8
EX4-6	OFF	OFF	OFF	ON	OFF	OFF	-	-
CV4*	OFF	OFF	ON	OFF	OFF	OFF	-	-
CV5-6	OFF	OFF	ON	ON	OFF	OFF	-	-
EX7**	OFF	ON	OFF	OFF	OFF	OFF	-	-
CV7	OFF	ON	OFF	ON	OFF	OFF	-	-
EX8	OFF	ON	ON	OFF	OFF	OFF	-	-
Step recovery - Yes	-	-	-	-	-	-	OFF	-
Step recovery - No	-	-	-	-	-	-	ON	-
Signal: 4-20 mA	-	-	-	-	-	-	-	OFF
Signal: 0-10V	-	-	-	-	-	-	-	ON

Note: *) settings to be used for CX4/5/6, **) settings to be used for CX7



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Function

The driver module EXD-U02 can be connected to any controller providing a 4...20 mA or 0...10 V analog signal. The output is the closing/opening signal to EX/CV valve series, and consequently the control of the refrigerant mass flow in accordance with the analog input. This feature allows extreme flexibility to system manufacturers, since they can use any desired controller and achieve different functionalities. The universal driver module keeps the valve at fully close position when the input signal is 4 mA or 0 V. The valve will be fully open at 20 mA or 10 V.

Digital Input Function (DI)

EMERSON's EX / CV stepper motor driven control valves provide positive shut-off* when they are driven to close position. The EXD-U02 DI allows closing the valve at any time regardless of the functional control input signal.

Operating condition	Digital input status
Valve is ready to operate	24 V
Valve fully closed	0 V


Note:

*) The positive shut off capability is available only when pressure at the inlet is > 0.5 bar than the outlet.

The 24 V DI is performed in parallel to the on/off compressor status, so both devices (compressor & valve) will work in parallel. Typical example of compressor power on/off sequence controlled from a thermostat signal directly. Also, it can be realized in an independent way, allowing the valve to stay operative regardless the compressor status (only for CO₂ applications).

Step recovery function

During the normal function of the valve, in certain cases it may happen that the valve lose some steps; EXD-U02 provides two different, selectable ways to manage the lost steps:

Function	Dip switch # 7	Description	
Mode 1:	"ON"	step recovery disabled With this setting, the EXD-U02 driver will not perform any recovering steps, as long as the DI input is ON; this may be suitable for applications where the valve may be called to operate even if the compressor is not running, like in some transcritical CO ₂ applications.	Note: If the step recovery function is disabled, it is recommended to interrupt the 24 V feed to the DI, in a regular base according to system designer, to ensure the valve is correctly synchronized.
Mode 2: (factory setting)	"OFF"	step recovery enabled With this setting, the EXD-U02 driver will perform a sequence of recovering steps according to the blue lined functions shown in the graphs: see Fig.1 The driver, as soon as the analogue input signal reaches the minimum value of 0.3 V or 4.5 mA, will start a step recovery procedure, closing a few steps in a periodic way. The step recovery stops after recovering up to 50% in closing direction. If the analog input value is 9.7 V or 19.5 mA, or higher, the driver will start a step recovery procedure, opening a few steps in a periodic way. The step recovery stops after recovering up to 50% in opening direction. This function is suitable if the DI is not going to be interrupted for a long period, and it's a way to ensure the valve is always properly aligned with the driver signal (not suitable for certain CO ₂ applications).	Note1: Please, ensure the capacity of the valve is enough according to the maximum required capacity from the system. Otherwise, the system will be asking for more capacity than the available, and this can be taken as an abnormality by the driver. Note2: Please use the DI to close valve. The recovery function may only be used when the compressor is in operation. Otherwise the valve might get damaged.

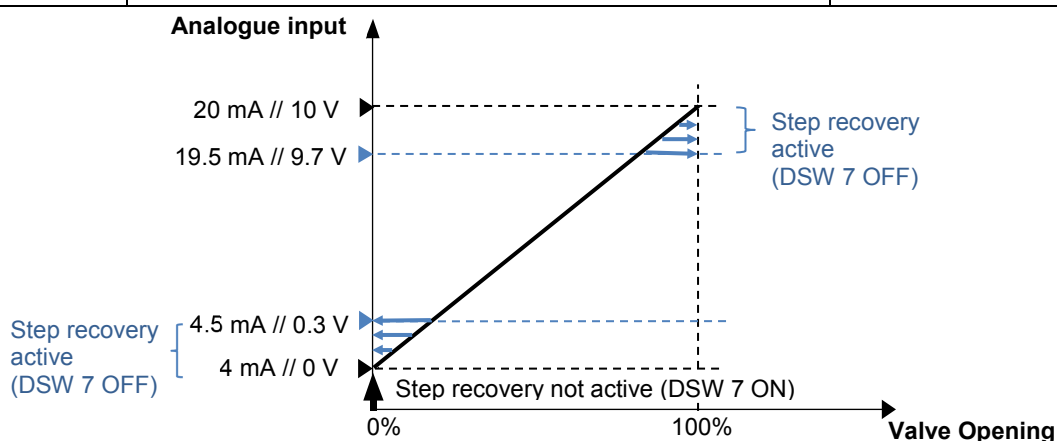


Fig.1

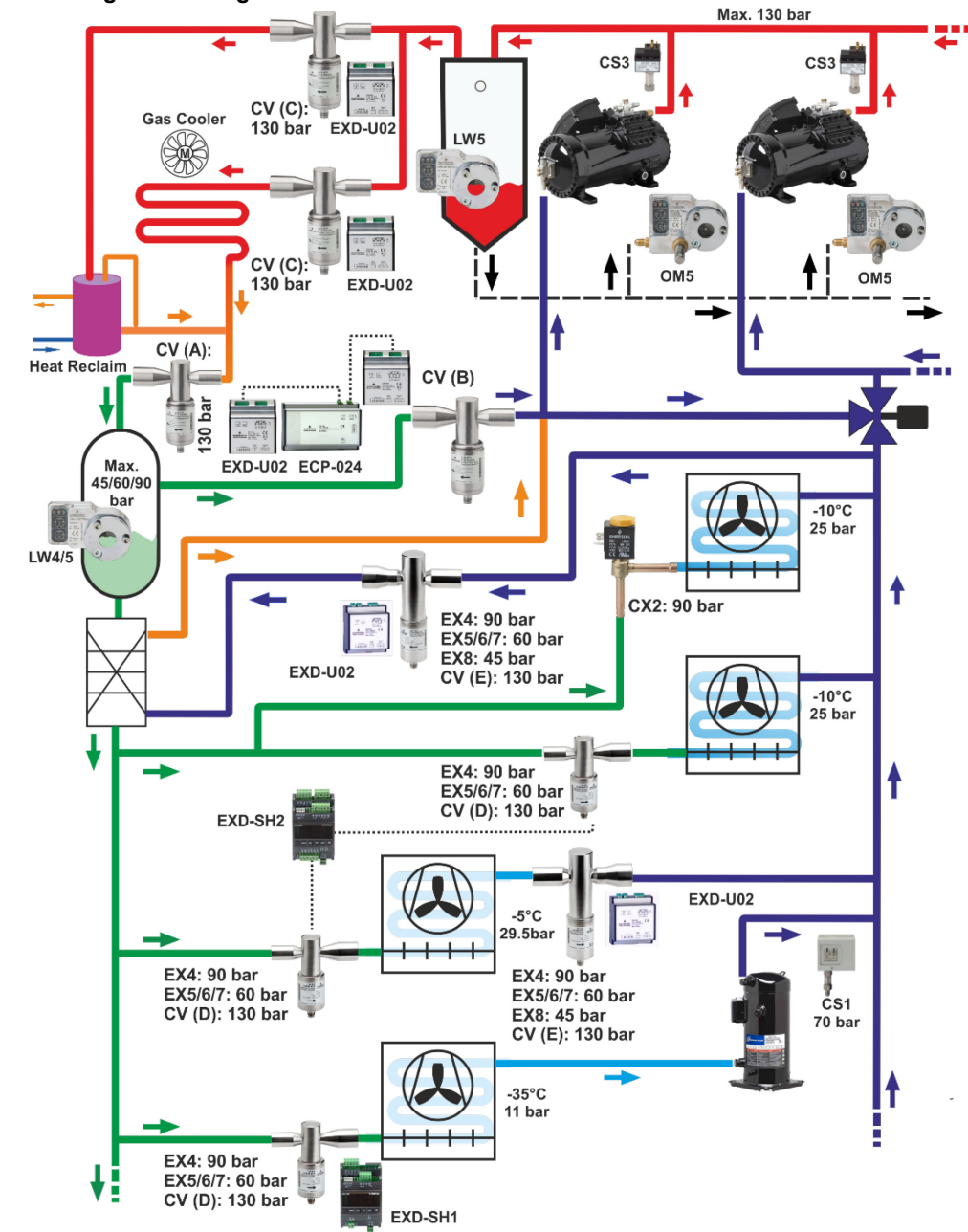
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Application of EXD-U02 in CO₂ Booster systems
 EXD-U02 in conjunction with CV and EX series provides various functions in CO₂ subcritical and transcritical systems.

Valve type	PS	PT	Duty/Application							
			Transcritical			Subcritical				
			High pressure gas valve	Heat reclaim	Hot gas	Flash tank bypass valve	Heat reclaim	Hot gas	Expansion valve	Suction
CV4-7	130 bar	186 bar	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EX4	90 bar	99 bar	No	No	No	No	Yes	Yes	Yes	Yes
EX5-7	60 bar	66 bar	No	No	No	No	Yes	Yes	Yes	Yes
EX8	45 bar	49.5 bar	No	No	No	No	Yes	Yes	Yes	Yes

Note: *) For expansion valve application, is recommended the use of Emerson EXD-SH1/2 controller with driver function instead EXD-U02.

CO₂ Refrigeration Diagram



In the diagram, a hypothetical booster conceptual refrigeration circuit is shown, with the purpose to propose different solutions available from Emerson for the different sections and fluids (refrigerant in several phases, oil). Please, contact your Emerson sales office for wider information regarding the products out of scope of this Technical Bulletin.

CO₂ Refrigeration diagram keys

A

High pressure gas valve

B

Bypass valve

C

Heat reclaim valve

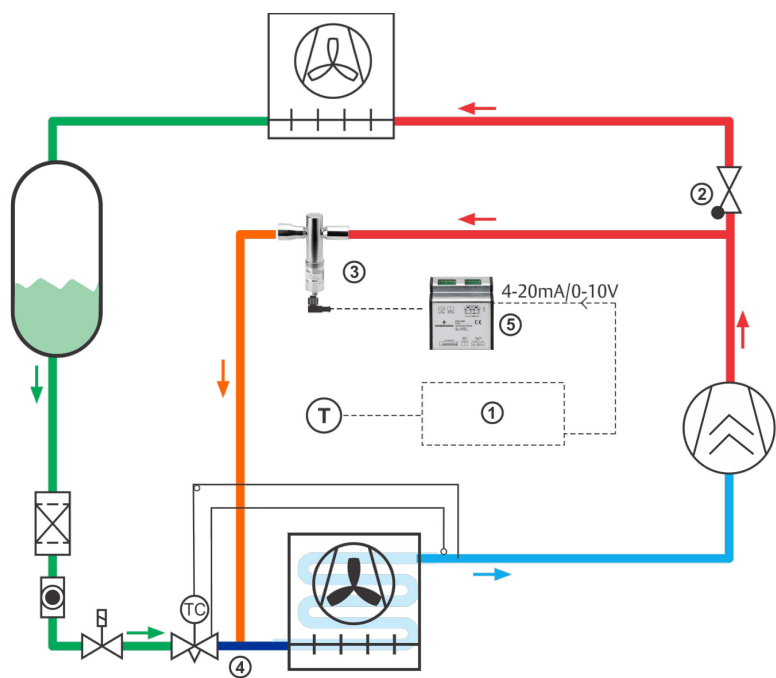
D

Expansion valves

E

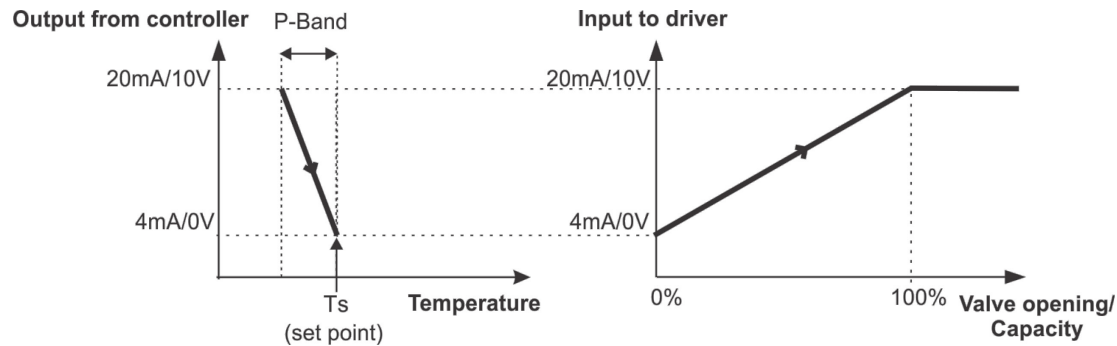
Suction pressure regulating valve

Application: Hot gas bypass with EX valve & EXD U02 driver



- Hot gas bypass application diagram keys**
- ① Temperature Controller
 - ② Check Valve: It is important to install a check valve just after T-connection as shown. Check valve will not allow return of liquid refrigerant from condenser through electrical control valve in to the evaporator during power interruption to system.
 - ③ Hot gas bypass valve must be installed with motor downward. This insures the valve life expectancy.
 - ④ Liquid Distributor must be selected properly for hot gas mass flow.
 - ⑤ Universal Driver Module EXD-U02

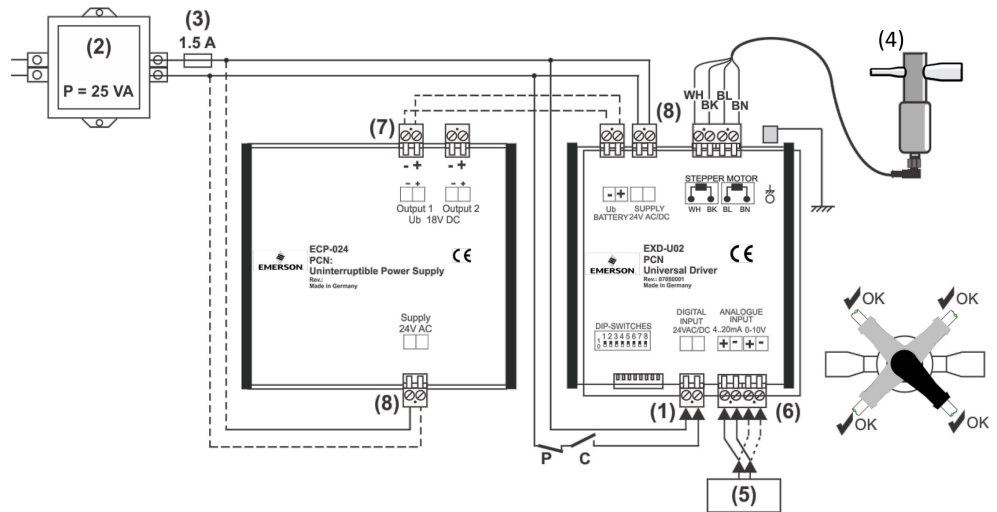
Capacity control / discharge air temperature control by means of hot gas bypass



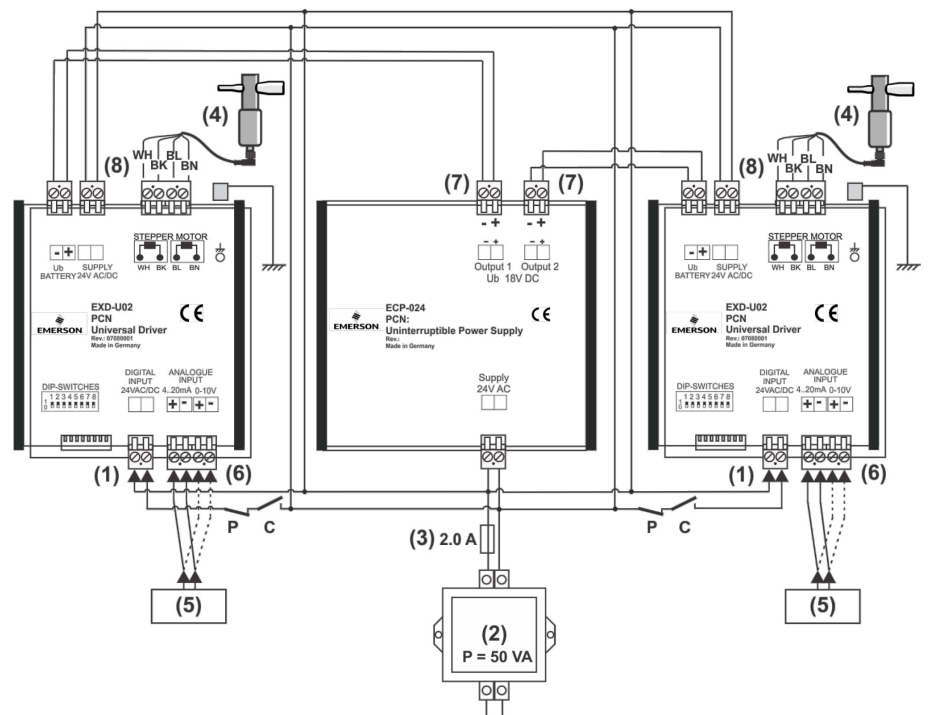
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Wiring Diagrams

One valve and one EXD-U02



Two valves and two EXD-U02



Wiring diagram keys

- (#1) Digital input terminals/signal (0 V = OFF; 24 V = ON)
- (#2) Transformer
- (#3) Fuse
- (#4) Plug cable assembly EXV-Mxx for connection to EX4-8 / CV4-7
Cable color code: WH=White BK=Black
 BL= Blue BN=Brown
- (#5) Third party controller's analogue signal supplies 4...20 mA or 0...10 V
- (#6) Analogue input terminal/ signal (4...20 mA or 0...10 V)
- (#7) **Optional** Uninterruptible Power Supply insures the closure of valve during power failure in system.
- (#8) Terminal (EXD-U02 /ECP-024) to be connected to single source. In event of power interruption, ECP-024 drive automatically the valve(s) to close position.
- (C) Normally open external potential free contact.
Function: Interruption of digital input for synchronization purpose or fully closing the valve.
- (P) Normally close external potential free contact (Pump down function)

EXD-U02 Universal Driver Module

Technical Data

Universal Driver Module EXD-U02

Supply voltage	24 VAC ±10%, 50-60 Hz <small>Note: 24 VDC supply voltage can be used but it results to lower MOPD and it needs to be changed by system manufacturer.</small>
Supply current	to be protected by a 1.0 A external fuse
Power consumption	10 VA in conjunction with EXV
Temperature	storage -20...+65°C operating 0...+60°C
Humidity	< 90% R.H. non-condensing
Protection class	IP20
Approvals	EMC EN 61326-1, EN50081, EN50082
Marking	CE

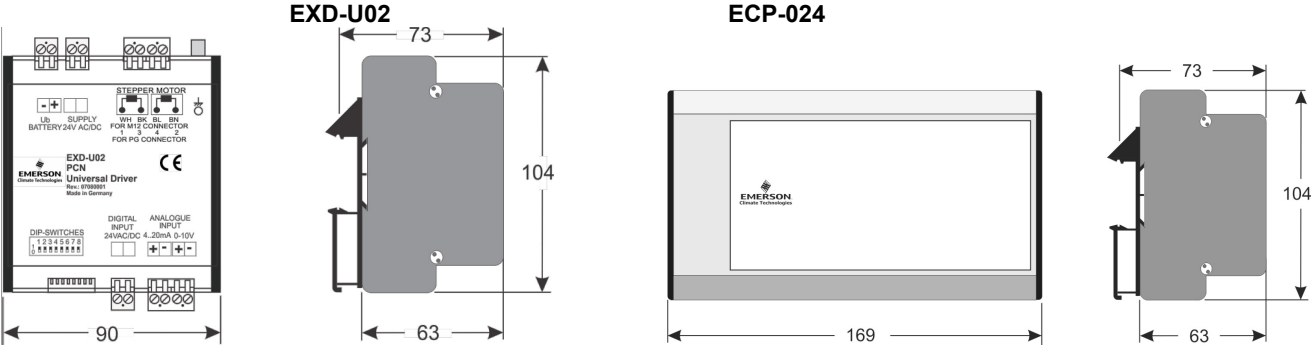
Analog input signal Burden	4-20 mA 364 Ω
Analog input signal Impedance	0-10 V 24 kΩ
Digital input	24 VAC ±10%, 50-60 Hz 24 VDC ±10%
Connection to EX4-8 & CV4-7	via 4 wires cable, AWG20/22
Connector	Screw terminals for wire size 0.5-2.5 mm²
Mounting	DIN rail mounted
Housing	Aluminum

Optional Uninterruptible Power Supply ECP-024

Backup battery type	Lead acid gel rechargeable battery
Number of backup batteries	2, each 12 VDC, 0.8 Ah
Supply voltage	24 VAC ±10%, 50-60Hz
Output voltage, UB	18 VDC
Number of outputs to drivers	2
Battery recharge time	approximately 2 hours
Approvals	EMC EN 61326-1, EN50081, EN50082
Marking	CE

Temperature:	Storage -20...+65°C operating -10...+60°C
Humidity	< 90% R.H. non-condensing
Connection	Screw terminals for wire size 0.5-2.5 mm²
Mounting	DIN rail mounted
Protection class	IP20
Housing	Aluminum

Dimensions (mm)



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