

M8/M12 Circular Connectors iCHP 宜技科技有限公司 I/O Connector

SiCHIP> 宜技科技有限公司

M8 / M12 Circular Connectors

Existing Products





M8 / M12 Circular Connectors

Basics



Originally designed for sensor cabling applications represented by IEC 60947-5-2 low voltage sensor switch devices

- M12 connectors are now recommended for nearly all fieldbus specifications
- Use to implement a flexible I/O or fieldbus connection on the circuit board

Circular connector system with locking screw (thread M8 or M12)

1mm round contact pin design like D-Sub

- mostly machined contacts are used for male and female
- stamped contacts may also be used
 - cost advantage

Coded mating face gives proper alignment

• avoid mismating

M8 / M12 Circular Connectors

Basics



Protection degree IP 65 / 67

• First number:

Protection against the ingress of solid particles or dust and protection against touching of parts which are under dangerous electrical voltage

6 = Totally protection against powder, dust and the access with a conductive wire

• Second number:

Protection against the ingress of liquids

- 5 = Protection against water jets
- 7 = Protection against the effects of immersion in water

Industrial Cabling Ethernet Protocol

- ISO 1188
- EN 50173
- IEEE803
- ProfinetStandard

M8 / M12 Circular Connectors

Basics



STETT 宜技科技有限公司

International Standards for M8 / M12 connectors

- IEC 60947-5-2 M12 A-coded
- Several Fieldbus standardsor M12 B-coded
- IAONA* M12 D-coded or ModJacks
- IEC 61076-2-101
- IEC 61076-2-104

for Low Voltage Sensor Switch Devices

or Profibus, Interbus, CAN, DeviceNet, etc

for Industrial Ethernet

circular connectors –design specification for screw locking M12 connectors for low voltage applications further M12 polarizations overtaken circular connectors –design specification for screw locking or snap locking M8 connectors for low voltage applications further M8 polarizations overtaken

- ProfinetInstallation Guide and AIDA**
- * IAONA Industrial Automation Open Networking Alliance
- ** AIDA Automation Initiative of German Domestic Automobile Manufacturers

M8 / M12 Circular Connectors

Features





Bulk

Tray



Tape and Reel



Bag

All parts meet IP 67 requirement Mechanical operation: > 100 mating cycles Current rating: up to 4A per contact Packaging

- Bulk
 - Design is very stable that bulk packaging has no impact to connector co-planarity
- Tray
- Tape and Reel
 - Additional pick-and-place cap for Vertical Male
 - Support automatic assembly
- Plastic Bag
 - For cable assemblies

M8 / M12 Circular Connectors

Features



STEFF 宜技科技有限公司





Two locating pegs with different shapes

- For exact board placement
- For better PCB hole tolerance compensation

M8 / M12 Circular Connectors

Features





Black insulation body and shiny terminals

STETT 宜技科技有限公司

• For easy visual recognition

Metal brackets and Solder Clips

- Provide exact position
- Absorb mating / withdrawal force or side forces
- Support higher retention force

Female contact with Modular Die design

M8 / M12 Circular Connectors

Coding





A –polarization (Sensor/actuator Application, DeviceNet, CAN open)



B –polarization (Fieldbus Applications like Profibus, Interbus)



D –polarization (4 Pin for Industrial Ethernet)



X –polarization (Gigabit Applications)



P -polarization (Not Tooled) (4 Signal + PE)



D -polarization (Not Tooled) (5 Pin for data applications)



C –polarization (Not Tooled)

GEHP 宜技科技有限公司

M8 / M12 Circular Connectors

Wiring and Cabling





M8 Circular Connectors

℃ 宜技科技有限公司 I/O Connector

GHP 宜技科技有限公司

M8 Circular Connectors

Overview – Male and Female





- M8 Female
- Contacts: Stamped
- Termination: SMT
- Assembly height: 9mm, 13mm
- Coding & pin count
 - A-coded, 3-, 4-pin
- Accessories
 - Metal shell
 - Front thread mount
 - O-rings



- M8 Male
- Contacts: Machined
- Termination: SMT
- Assembly height: 9mm, 13mm
- Coding & pin count
 - A-coded, 4-pin
- Accessories
 - Metal shell
 - Front thread mount
 - O-rings

GHP 宜技科技有限公司

M8 Circular Connectors

Overview-Cable Assembly





- Male or female
- Cable PVC or PUR
- Straight or angled
- A-coded, 3-, 4-pin, black



- Connectors on both sides or open end of line
- Different lengths
- Angled version optional with LED



- Quick termination Field attachable
- Male or female straight
- IDC connection
 - Without hand tools
- Ten-times connectable
- Integrated strain relief
- Vibration-proof screw locking
- Suitable for cable dia.
 3.2mm –5.4mm
- A-coded, 3-, 4-pin

GEHP 宜技科技有限公司

M8 Circular Connectors

Applications







- M8 A-coded unshielded cable
- 3-, 4-pin for standard sensors and IO boxes

- M8 A-coded shielded cable
- 4-pin for special apps like power supply

M12 Circular Connectors ffff 宣技科技有限公司 I/O Connector

M12 Circular Connectors

Overview - Female







Protective Caps



- Contacts: Stamped, Machined
- Termination: SMT (THR partly available)
- Assembly height: 9mm, 13mm
- Coding & pin count
 - A-coded, 4-, 5-, 8-pin B-coded, 5-pin
 - D-coded, 4-pin

- Accessories
 - Female metal shell
 - Front thread mount
 - Optional counter nut for 13mm version
 - O-rings
 - Protective caps

GHP 宜技科技有限公司

M12 Circular Connectors

Overview -Male





- Contacts: Machined
- Termination: SMT (THR partly available)
- Assembly height: 9mm, 13mm
- Coding & pin count
 - A-coded, 4-, 5-, 8-pin
 - B-coded, 5-pin
 - D-coded, 4-pin

- Additional sealing option
- Accessories
 - Male metal shell
 - Front thread mount
 - Optional counter nut for 13mm version
 - O-rings
 - Protective caps

M12 Circular Connectors

Male and Female Extra Sealed





Target applications

- Sealing against water when cable connector is not mated, e.g. useful while installation or service
- Useful for devices which are potted with epoxy or similar fluids after manufacturing, device for use in harsh environments

New parts

- M12 female with machined female contacts and optional O-ring, 4-, 5-and 8-pin
- M12 male with O-ring groove; standard version in future, 4-, 5-and 8-pin

M12 Circular Connectors

Counternutfor 1mm Frontplace





M12 Circular Connectors

Male Direct Integration





New parts

- Male with O-Ring groove for plastic housings with moulded M12 thread
- 4-, 5-and 8-pin SMT
- 4-, 5-and 8-pin THR
- Assembly height 9mm
- Tray packaging (no T&R or plastic bag available)

GEHP> 宜技科技有限公司

M12 Circular Connectors

Definition of Assembly Height





Standard assembly height with 9mm



Standard assembly height with 13mm

M12 Circular Connectors

Sealing Option for Male Side







- Note: Two sealing options for M12 male are useable
- Style 1 O-Ring has only contact with metal shell
- Style 2 O-Ring has contact to connector and metal shell

CHIP 宜技科技有限公司

M12 Circular Connectors

Overview – Cable Assembly





- M12 male or female
- Cable PVC or PUR
- Straight or angled
- A-coded 4-, 5-, 8-pin black
- B-coded, 5-pin magenta (on request)
- D-coded, 4-pin green/waterblue (on request)



- Connectors on both sides or open end of line
- Different lengths
- Angled version optional with LED



- Quick termination
 - Field attachable
- Male or female straight
- IDC connection
- Ten-times connectable
- Integrated strain relief
- Vibration-proof screw locking
- Suitable for cable dia. 4.0mm –5.1mm
- A-coded 4 pin
- B-coded, 2-pin (on request)
- D-coded, 4-pin (on request)

GEHP 宜技科技有限公司

M12 Circular Connectors

Applications





- M12 A-coded unshielded cable
- 2-, 3-, 4-, 5-pin for standard sensors and I/O boxes
- 8-, 12-, 17-pin for more complex sensors



- M12 A-coded unshielded cable
- Sensor bus ASI 2/4 pin
- Sensor bus IO-Link 4/5-pin
- Power Supply for devices



- M12 A-coded shielded cable
- Fieldbus CANbus (DeviceNet) 5-pin

M12 Circular Connectors

Applications





- M12 B-coded shielded cable
- Fieldbus Profibus, Interbus, SafetybusP



- M12 D-coded shielded cable
- Industrial Ethernet applications
- CAT 5
- Profinet and others

M12 X-coded Gigabit Connector System

M12 Circular Connectors

X-coded Gigabit Connector System



STEFF 宜技科技有限公司



Picture: copy out of the standard

- IEC 61076 -2-109 / DIN EN 61076 -2-109
- Initiated from PhönixContactand Harting
- Data transmission up to 500 MHz
 10 Gbit/s (Cat 6a)
- Female, 8 pin –4 differential pairs
- each pair shielded against each neighbour pair shield inside looks like a "X" >> Xcode

M12 Circular Connectors

X-coded Gigabit Connector System





- SMT/THR pins
 - SMT signal pins > signal integrity
 - THR shield pins > mechanical robustness
- P&P and T&R packaging for automated assembly
- HF-Test acc. IEC 61076 -2-109 available
- Intermateability with all cable connector solutions on the market which have a mating face acc. to IEC 61076 -2-109 / DIN EN 61076 -2-109

GEHP> 宜技科技有限公司

M12 Circular Connectors

X-coded Gigabit Connector System





GEHP> 宜技科技有限公司

M12 Circular Connectors

X-coded Gigabit Connector System

Technical data

Criteria		Values
Current Rating at T _{amb} 40° C	all contacts	0,5 A
	single contact	1,0 A
Operating voltage	Ethernet networks	48 V
Voltage Proof	contact-contact	0,5 KV
	contact -shield	0,5 KV IEC value
Contact resistance		< 5mΩ
Isolation resistance		> 10 ⁷ Ω
Protection class	IEC 60529	IP65 / 67
Mating cycles		100
Mating force		max. 30 N
Withdrawing force		max. 30 N
Polarization force		min. 35 N



M12 Right Angle Connector

GEHP 宜技科技有限公司

M12 Circular Connector

New Angled Version





CHP 宜技科技有限公司

M12 Circular Connector

New Angled Version -Design Features





- Extremely space saving due to be placed on PCB central axis
 Center Plane of PCB = Center Axis of Connector
 * However a fully automated assembly process is possible on SMT-standard machines
- Pin count: 3-, 4-, 5-pin
 - 8-pin under development
 - Early mate last break option for pin 5
- Termination: THR
- Protection degree: IP 67 (Optional IP 68 / 69k possible)
- UL listed polymer plastic PPA
- Suitable for potting after assembly due to redundant sealing function

CHIP 宜技科技有限公司

M12 Circular Connector

New Angled Version -Design Features





- Pegs and integrated PCB support areas
 - Ensure a secure position while soldering
- Pins soldered on top & bottom side of the PCB
 - Extremely robust
- Special design of the solder pins compensates assembly tolerances

M12 Circular Connector

New Angled Version -Design Features





- With full capability for automated Pick & Place assembly
 - T&R packaging, with Integrated pick & place area
- Leadfree reflow compatible
- High CTI-value of 600 for rough environmental applications
 - Allows lower creepage distance

M12 Circular Connector

New Angled Version -PCB Thickness



- Connector with integrated PCB support points
 - Integrated holder ensures adoption of 3 different PCB thicknesses

STETT 宜技科技有限公司

- 1.0 / 1.6 / 2.0mm *

* Note:

Other thicknesses in between of the mentioned range can be used, if the non centric position in this case is taken into account. The support points have to be considered according the chosen PCB thickness. The PCB has to be designed to provide those supports.



GEHP 宜技科技有限公司

M12 Circular Connector

New Angled Version -EMC Protection







- 360° Shield Ring (Optional)
 - Snapped on the insulation body
 - Soldered to the PCB
 - Make contact to metal shell
 - Terminates the M12 shell to ground
 - Has a twist torque of min. 5 Nm

GHP 宜技科技有限公司

M12 Circular Connector

New Angled Version - Male Front Mount for Sensor Pipe





- End assembly front mount type
 - A-coded, 3-, 4-, 5-pin
 - Integrated O-ring
 - Optional shield ring
 - Accessories
 - O-ring
 - Protection cap
- Snap-in version
- Antitwist version

M12 Circular Connector

ERNI

New Angled Version - Male Front Mount for Sensor Pipe



Snap-in version

Antitwist version

GHP 宜技科技有限公司

M12 Circular Connector

New Angled Version -Male Rear Mount





- End assembly rear mount type
 - A-coded, 4-, 5-pin
 - B-coded, 3-, 5-pin
 - D-coded, 4-pin
 - Integrated O-ring (optional)
 - Optional shield ring
 - Accessories
 - O-ring
 - Locking shell
 - Protection cap

M12 Circular Connector

New Angled Version -Male Rear Mount Assembling

 Image: Image:

Rear mount standard

Rear mount with counter nut

Dimensions and assembly recommendation for standard device when ERNI M12 locking shell is used





M12 Circular Connector

New Angled Version – Male Rear Mount & Assembling (DI Type)



Rear mount integration in die cast housing When a housing with integrated M12 thread is used (only for die cast recommended)

Male rear mount assembling (DI Type)

- End assembly rear mount DI (direct integration) type
 - 4-, 5-pin
 - Optional shield ring
 - Accessories: O-ring



Rear mount integration in plastic housing DI type when a plastic housing with integrated M12 thread is used



M12 Circular Connector

New Angled Version -Female Rear Mount





- End assembly rear mount type
 - A-coded, 4-, 5-pin
 - B-coded, 3-, 5-pin
 - D-coded, 4-pin
 - Integrated O-ring (optional)
 - Optional shield ring
 - Accessories
 - O-ring
 - Locking shell
 - Protection cap

M12 Circular Connector

New Angled Version -Female Assembling







Rear mount standard

Rear mount with counter nut

Dimensions and assembly recommendation for standard device when ERNI M12 locking shell is used

M12 Circular Connector

New Angled Version -Female Rear Mount (DI Type)





Rear mount integration in die cast housing When a housing with integrated M12 thread is used (only for die cast recommended)

Female rear mount assembling (DI Type)

- End assembly rear mount DI (direct integration) type
 - 4-, 5-pin
 - Optional shield ring
 - Accessories: O-ring



Rear mount integration in plastic housing DI type when a plastic housing with integrated M12 thread is used

M12 Circular Connector

New Angled Version - Application example using Threaded Shells



Colorsof components on sketch do not represent real parts

STETHT 宜技科技有限公司



M12 Circular Connector

New Angled Version - Application example using Threaded Shells







GEHP> 宜技科技有限公司

M12 Circular Connector

New Angled Version -Processing



If more than one connector is used in a row, min. distance 20.32mm



SiCHIP> 宜技科技有限公司

M12 Circular Connector

New Angled Version -Solder Processing





M12 Circular Connector

New Angled Version -Solder Paste Printing





CHIP 宜技科技有限公司

M12 Circular Connector



New Angled Version -Solder Results WITHOUT Preform









- Solder results without Preform
- Solder paste
 Senju M705-GRN360-K1
 solder grain size 32 µm
- Stencil thickness 150 µm
- Overprinting applied
- Standard reflow profile according JEDEC J-STD-020C

M12 Circular Connector

New Angled Version -Solder Results WITH Preform











Solder results with Preform

- Solder paste Senju M705-GRN360-K1 solder grain size 32 µm
- Stencil thickness 150 µm
- Overprinting applied
- Lotpreform size 0402 applied
- Standard reflow profile according JEDEC J-
- STD-020C

Solder is fuller!

SiCHIP> 宜技科技有限公司

M12 Circular Connector

New Angled Version -Solder Preform







ERN

M12 Circular Connector

New Angled Version -Layout (ERNI v.s. Competitors)

ERNI's layout solution is space saving compared to other competitors!

M12 Circular Connector

New Angled Version -Assembly Height (ERNI v.s. Competitors)

ERNI's layout solution is space saving compared to other competitors!

SiCHIP> 宜技科技有限公司

M12 Circular Connector

New Angled Version - Target Applications

M12 Circular Connector

New Angled Version -Target Applications

GEHP 宜技科技有限公司

Additionals felff 宜技科技有限公司

GHP 宜技科技有限公司

M8 / M12 Circular Connectors

Special Adapters

T-Coupler

- M12-M12 duo adapter
- M12-M8 duo adapter
- Used for space saving sensor connectivity.
- Two sensors /actuators can be merged to one cable.

M8 / M12 adapter

- M8 Male -M12 Female
- M12 Male -M8 Female
- A-coded, 3-/ 4-pin
- Useful to reduce number of different parts
- Recommended for service issues i.e. replacement of cables as they allow greater flexibility

M12 Panel Feed-Through

- M12-M12
- A-coded, 5-pin
- B-coded, 5-pin
- Used when cables need to pass through cabinets, racks or other electrical devices.
- Ensure protection against dust and water immersion

Distribution Box

- M12 IO Box
- M8 IO Box

Reference Projects ffffi² 宜技科技有限公司

ERNI

Reference Projects

Design Win in Asia

- Design Win Location: Singapore
- Industry: Automation
- Application: Ethernet switch for robotics
- ERNI Products: 4 Position Female M12 SMT Connector

- Design Win Location: Taiwan
- Industry: Railway
- Application: Ethernet Switch for train equipment
- ERNI Products: 4, 5 & 8 Position Female M12 SMT Connector

Reference Projects

Design Win in Europe

SIEMENS

Digital I/O module

Analog I/O module

- Industry: Automation
- Application: Distributed I/O device ET200X
- ERNI Products: 5 Position Female M12 SMT Connector

Reference Projects

Design Win in Europe

STEFF 宜技科技有限公司

- Design Win Location: Italy
- Industry: Automation
- Application: Valve Terminal
- ERNI Products: 3 Position Female M12 SMT Connector

- Design Win Location: Germany
- Industry: Automation
- Application: Valve Terminal
- ERNI Products: 3 Position Female M8/M12 Press-fit

Reference Projects

Design Win in Europe

- Design Win Location: Germany
- Industry: Automation
- Application: I/O Modules for Control
- ERNI Products: 4 Position Female M12 SMT Connector

CONTACT

- Design Win Location: Germany
- Industry: Automation
- Application: M8 Bus Module
- ERNI Products: 3 Position Female M8 SMT Connector

Summary ffffi² 宜技科技有限公司

GEHP> 宜技科技有限公司

M8 / M12 Circular Connectors

M12 Connector vs. Modular Jack

Advantages of M12 connector over RJ45 Modular Jack

	M12	RJ45
Robustness	Robust	Movement of cable results in movement within the mating area
Locking	Threaded shell	Weak snap in clip
IP Rating	IP 65/67 (sealing against water)	IP40 (for common RJ45)
Size	Relatively small	Bulky,especially for waterproof version
Applications Environment	Recommended for harsh environment	Recommended for office and cabinet

M8 / M12 Circular Connectors

Important Notes

Always recommend standard parts that could be found on ERNI website

Customized parts are too expensive, longer lead time, and with certain MOQ

R&D from EA is working on M8 / M12 Cable Connector solution at the present

- Once it is done we could support M8 / M12 cable assemblies from ETH
- Till then, we do not promote M8 / M12 cable assemblies from EPG as they are outsourced
 - If needed, only recommend standard cable assemblies p/nfrom ERNI website
 - Customized cable assemblies are too expensive

M8 / M12 Circular Connectors

Unique Selling Points

First circular connector in SMT (reflow compatible)

- Allows high cost savings regarding assembly and material
- Standardized mating face
- Two assembly heights as an ERNI-standard
- Cost effective stamped female contact, available also in pressfit
- Also THR versions available
- Direct integrative male connector available especially for full plastic housing solutions
- Extra sealed parts for casting/potting available
- Part kit for customized products and assembly heights
- Accessories like threaded shells, O-rings, protective caps

SHIP 宜技科技有限公司