MRU 688X

USER MANUAL

REFERENCE: UM-MRU688X-1.0-EN

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PREFACE

Purpose of this manual

This manual presents the BALOGH UHF readers MRU688x models.
It describes how to install and how to use them.

Further information pertaining to the data interfaces described in this manual can be found in the Interface Manual (reference IM-MRU-II-L)

Document naming conventions

The coding used for a manual name is:
        UM- <device name>-x.y-L
in which:
        UM signifies User Manual
        x.y refers to the issue or version number
        L refers to the language of the manual

Document status sheet

Version	Date	Description of changes
1.0	14/07/2014	Creation (translation of French version 1.0)

Note

The contents of this manual are subject to changes without notice.
BALOGH cannot be held responsible for the consequences of any error, omission, or incorrect interpretation of the information provided

UM-MRU688x-1.0-EN

CONTENTS

1 DESCRIPTION OF READER

1.1 GENERAL DESCRIPTION

The MRU readers allow remote identification on the fly, reading and writing of UHF tags
The reader is a compact all-in-one device. The weatherproof housing of sober design contains all the functional elements of the reading unit: Antennas, Microwave generator, receiver, CPU and communication interface.
The reader can be mounted directly onto any panel, even a metallic one. An optional tilt and swivel mount, ACS 8310, allows installation on both poles and flat surfaces. In this way the antenna can be appropriately pointed to the zone where the tags need to be identified.

The main characteristics are as follows:

- Case dimensions: 186 x 186 x 33mm
- Overall dimensions: 186 x 186 x 58 mm
- Weight: 1,8Kg
- Cover colour: Grey RAL 7035
- IP65 protection
- Power requirements: between +12Vdc and +24Vdc, max current 1.5A.
- Operating temperature: -20°C to +50°C

1.2 WARNING

Installation of readers must only be done in zones where the technical and environmental conditions comply with those specified by the manufacturer.

BALOGH cannot be held responsible for any damages caused by an incorrect installation.
Any changes made to the device will immediately nullify the warranty.

1.3 COMMUNICATION INTERFACES

These readers can be used in place of most conventional controllers, both contact and contact-less.
Communication with a "host" system takes place using the following standardised links:
- Open-collector: DATA/CLOCK, WIEGAND 26bits
- Serial asynchronous: RS232, RS422 or RS485, ETHERNET, USB (usable also for service)

These interfaces cannot operate simultaneously, only one at a time is to be used.

For the USB, RS and ETHERNET links, full two-way communication is possible using the MODBUS™ protocol. For some versions, all the interfaces are not available simultaneously.

These readers are also equipped with:
- 1 An opto-coupled digital output that can be configured to switch either via a command sent from the host or automatically at each tag identification.
- 1 An opto-coupled digital input which can be used to globally enable or disable tag reading.

1.4 POWER SUPPLY

The readers must be powered between 12 & 24 VDC.
A special detector ensures that if the input voltage is too low then the reader will not power up.
Powering the reader from a mains outlet requires an AC adaptor of at least 18W.
Its recommended to use a linear stabilized AC adaptor

1.5 MODELS AVAILABLE

Antenna polarization Host Interface	Circular	Horizontal	Vertical
Wiegand 26 bits ; ISO-2 Input/Output USB	**MRU6882 TTL**	**MRU6883 H TTL**	**MRU6883 V TTL**
Wiegand 26 bits ;ISO-2 Input/Output RS 232, RS 422, RS 485 USB	**MRU6882 RS**	**MRU6883 H RS**	**MRU6883 V RS**
Wiegand 26 bits ; ISO-2 Input/Output RS 232, RS 422, RS 485 ETHERNET USB	**MRU6882 ETH**	**MRU6883 H ETH**	**MRU6883 V ETH**

1.6 OVERALL DIMENSIONS
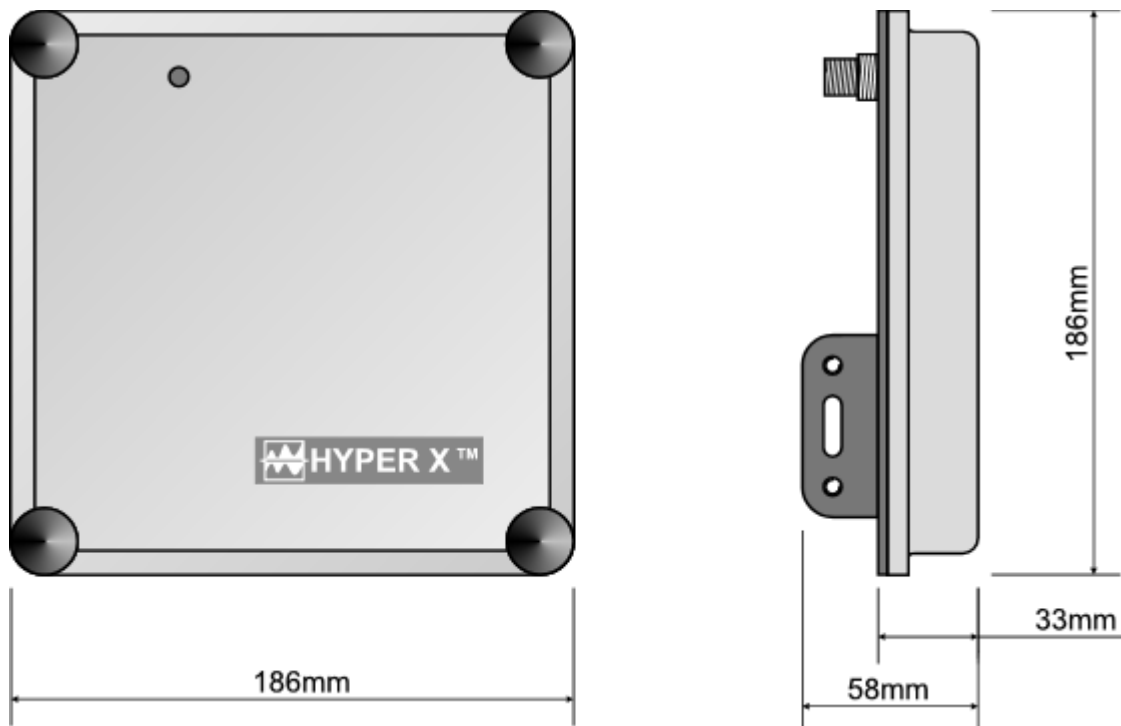
2 INSTALLING THE MRU READER

At the rear of the reader are two mounting brackets.
These brackets have self-clinching nuts size M6 allowing mounting on any support structure (e.g. support angles with screws)
These brackets also have oblong holes allowing plastic or metallic collars to pass through.

A mounting kit ACS 8310 allowing easy installation of the reader is available as an accessory. This kit contains:
 - a tilt bracket which allows adjusting the tilt angle
  - a wall-mounting support which allows adjustment of horizontal rotation
  - metallic hose clamps Ø30mm for attaching the tilt mount onto the support structure
  - mounting screws for attaching the reader onto the tilt bracket

All the pieces are made of stainless steel.
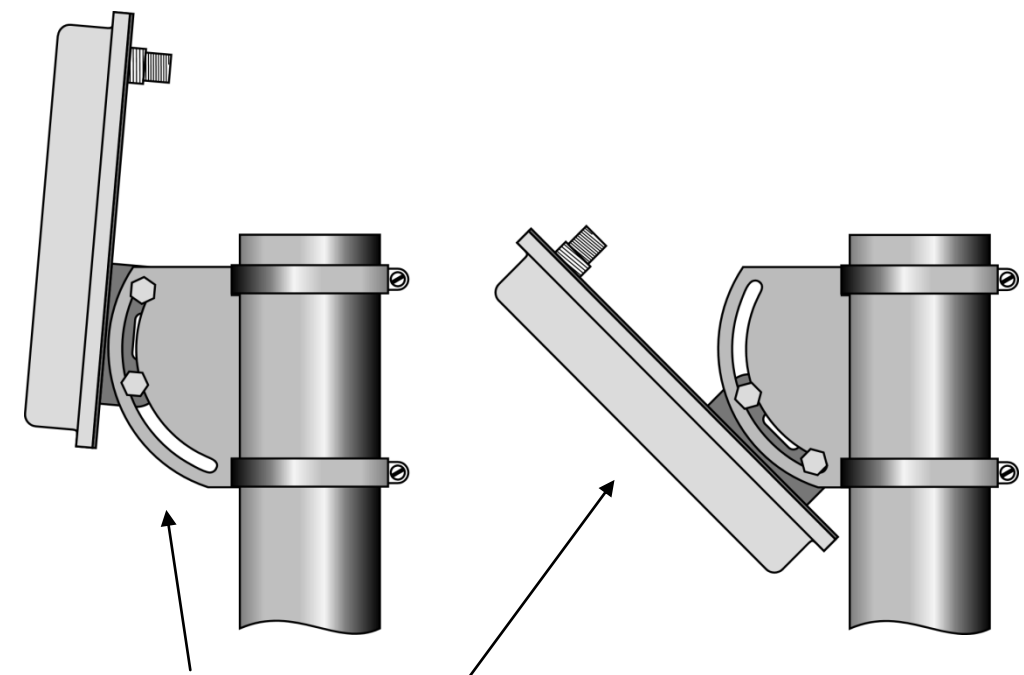
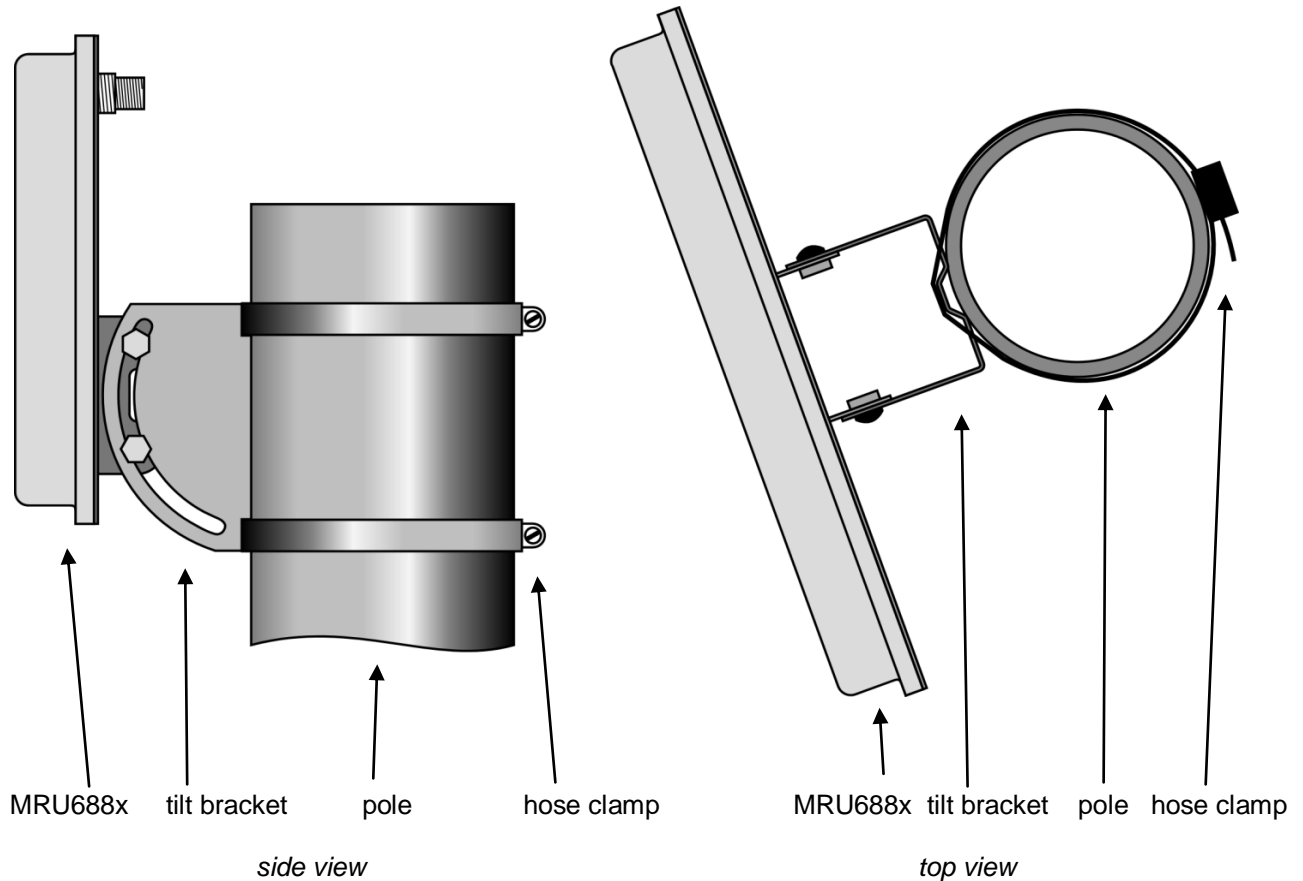## 2.1 MOUNTING ON A POLE

2.1.1 DIRECT MOUNTING

The reader can be mounted directly onto a pole by with a hose clamp that passes through the openings in the brackets. This type of mount only allows horizontal rotation:

| MRU688x | pole | hose clamp | MRU688x | pole | hose clamp |

side view   *top view*

UM-MRU688x-1.0-EN
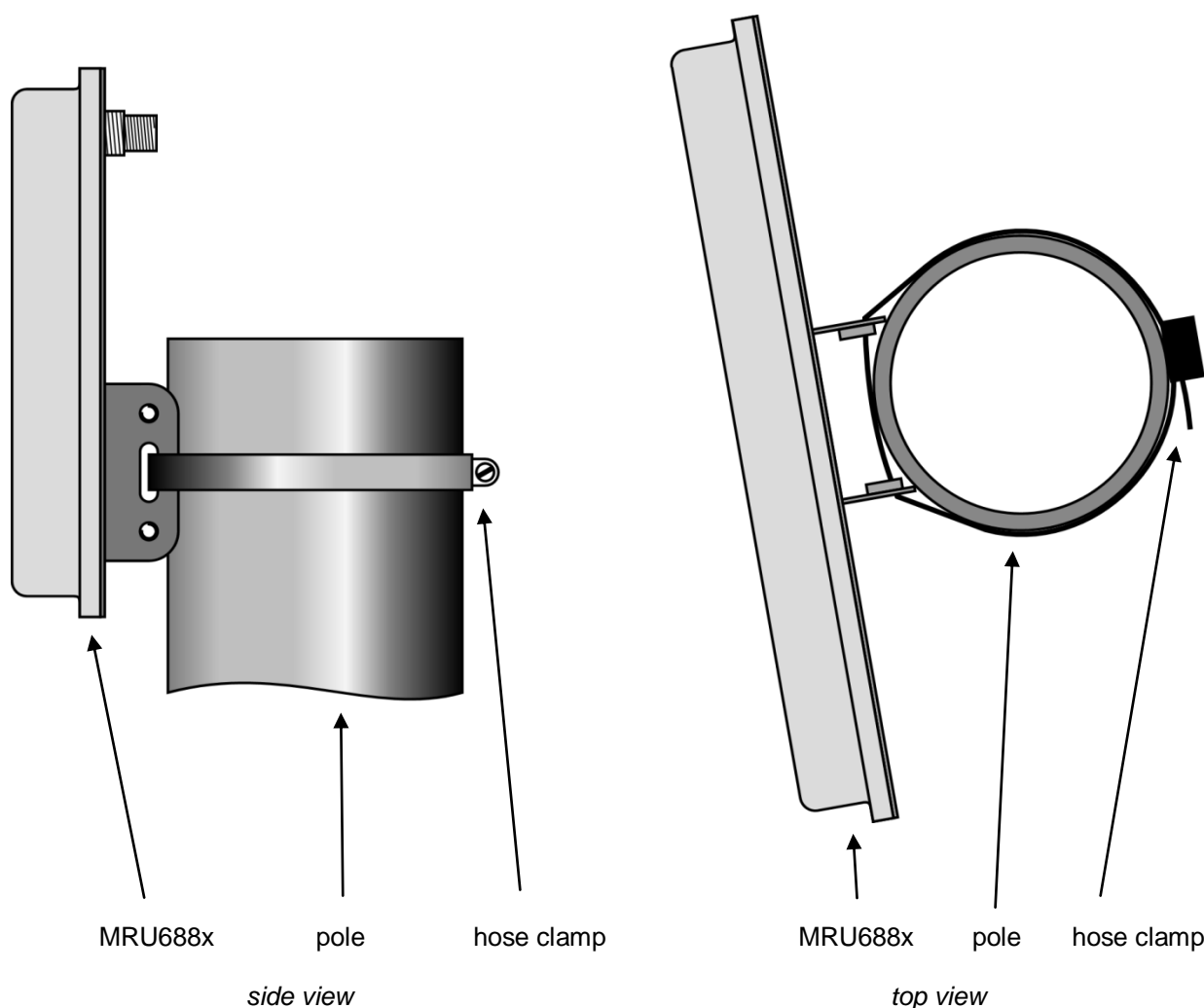
2.1.2 MOUNTING USING THE TILT BRACKET

The reader is mounted onto the bracket using the 4 screws provided; the bracket is mounted onto the pole using the hose clamps. Depending on the diameter of the pole, the hose clamps provided may be suitable, otherwise larger hose clamps (not provided) may be needed. This type of mount allows both horizontal and vertical rotation.

MRU688x   tilt bracket   pole   hose clamp

side view

MRU688x tilt bracket   pole hose clamp

top view

The tilt angle can range from 5° upwards to 45° downwards

2.2 MOUNTING ON A WALL

2.2.1   MOUNTING USING THE TILT BRACKET

The tilt bracket has 4 holes for wall mounting.

- screws Ø6mm max
- screw type must be chosen to suit wall material
- 40mm between axes in both directions

| MRU688x | tilt bracket | wall | | MRU688x | tilt bracket | wall |

side view   *top view*
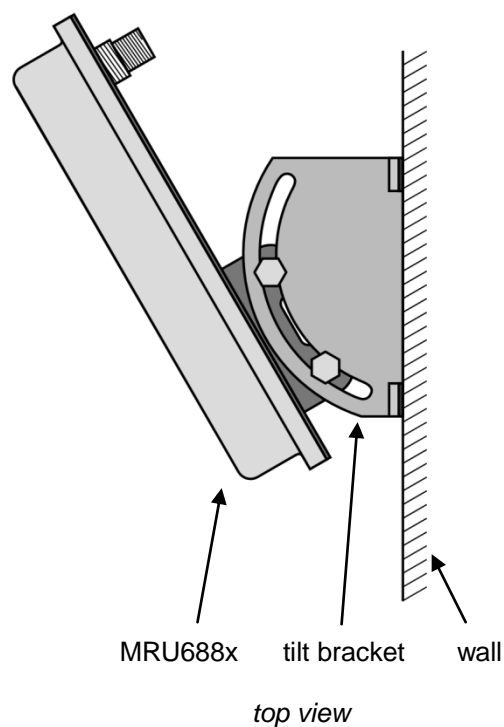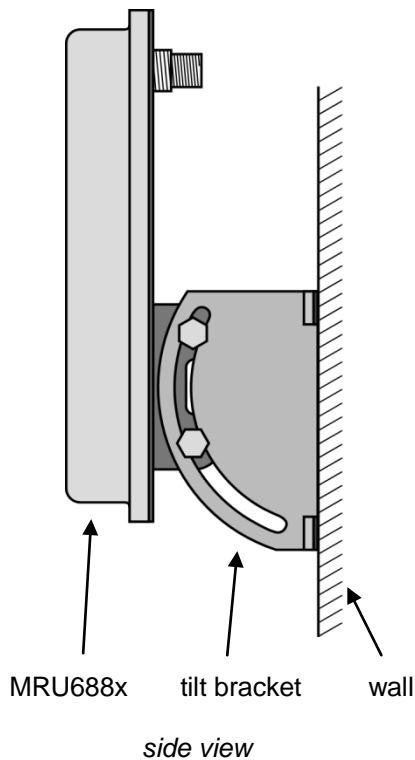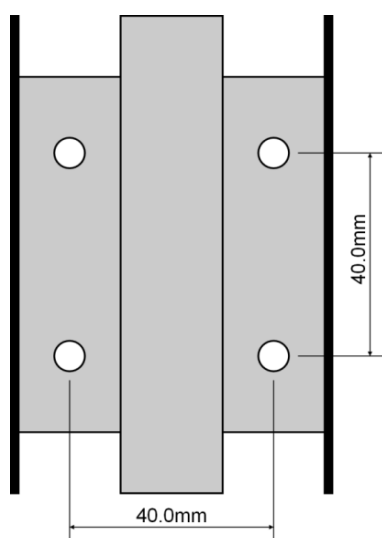
This type of mount only allows a vertical tilt adjustment from 5° upwards to 45° downwards.
Note: by rotating the bracket 90° (wings are horizontal), horizontal rotation becomes possible.

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2.2.2 MOUNTING WITH WALL BRACKET

This bracket, provided in the kit, has 4 mounting holes, whose locations are identical to those of the tilt bracket. Mounting onto the wall is identical:
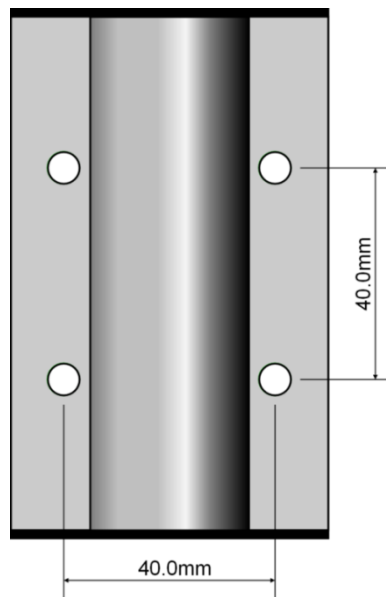
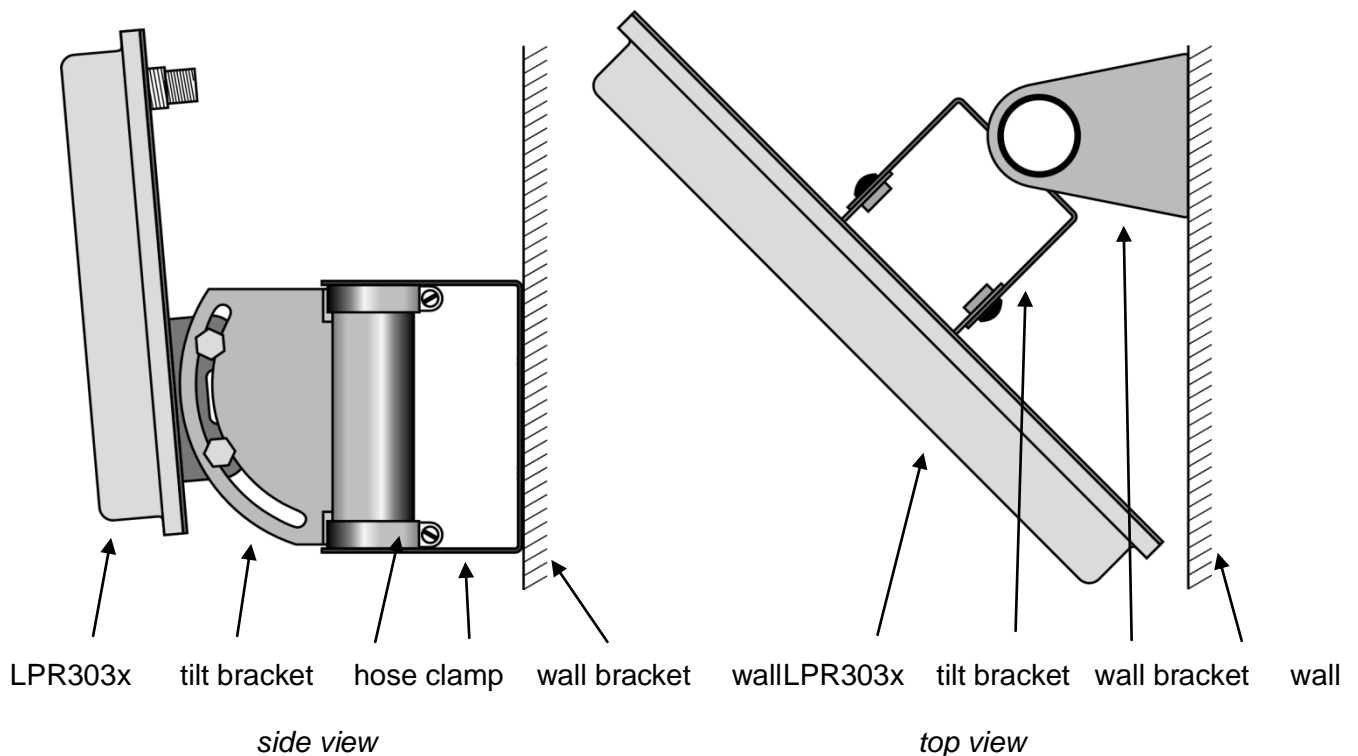The tilt bracket is attached to the wall bracket with the 2 metallic hose clamps provided.
This type of mount allows both horizontal and vertical rotation:

LPR303x   tilt bracket   hose clamp   wall bracket   wallLPR303x   tilt bracket   wall bracket   wall

side view   *top view*

The tilt angle can range from 5° upwards to 45° downwards.
With the reader pointing 45° downwards and mounted on a wall, the maximum horizontal rotation is roughly 30°.
When there is no tilt, the horizontal rotation can reach 50° on either side.

2.3 POSITIONING OF READER

The directivity of the reader's antenna is a symmetrical 70° x 70°.

Side view   Top view
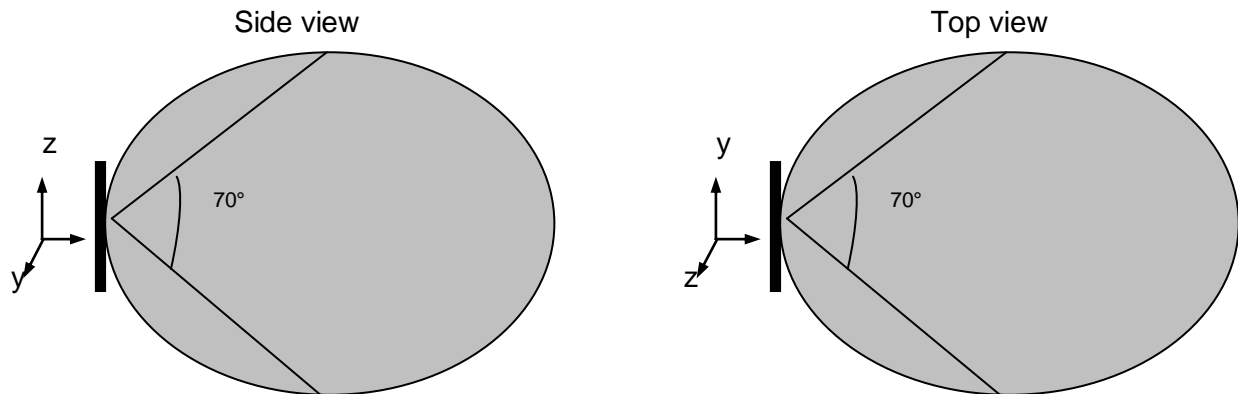
**ATTENTION: MRU6883 H & V models dispose of a linear polarisation antenna.
Reader's polarisation is to be on the same axis than tag installation, H= horizontal,
V= vertical; not respecting this can cause a leak of performance.**

Position the reader so that it points to the zone where the tags are likely to be. Maximum performance is achieved with the line of sight, perpendicular to the face of the reader.
Direction of main radiation is always perpendicular to the face of the reader; excessive tilt angle between tag and antenna surface is not admissible and preferable to be less than 30 degrees; at 45 degrees the reflected signal fall down drastically.

With the optional mounting kit ACS 8310, the reader can now be pivoted. The orientation can be freely adjusted. Pivoting can be either horizontal (side to side) or vertical (up and down).

When positioning the reader, the following recommendations should be followed:

Avoid placing the reader in direct sunlight, where overheating may cause the internal electronics to reach temperatures above those recommended for normal operation.
If this is not possible then a sun-shield should be mounted.

When two or more readers are situated in the same zone, make sure they are not pointing towards each other. If necessary, their pointing axes should be slightly redirected.

Do not install a reader close to a source of potential interference in order not to degrade its performance.

The main sources of interference are:
- Devices operating in the same band of frequencies, such as wireless communications devices,
- Fluorescent lighting,
- Metal objects such as gratings, fences or heat-reflective vehicle windscreens,

Etc.

2.3.1   INSTALLATION EXAMPLE: INCLINED FRONTAL READING ZONE
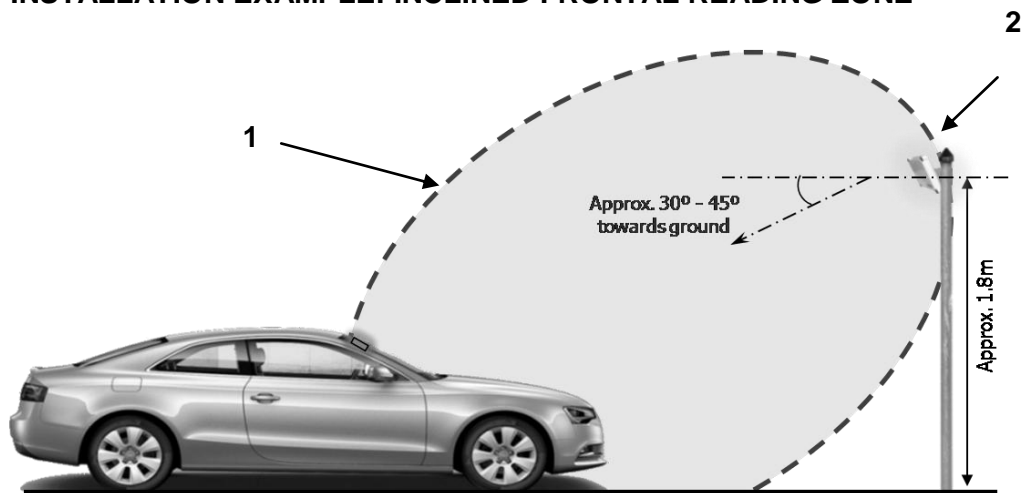
Approx. 30º – 45º towards ground

Approx. 1.8m

1	Theoretical identification zone
2	Reader. The reader should be positioned so that the angle is between about 30 and 45 degrees down towards the vehicle.

4m max

Approx. 30º angle towards vehicle path
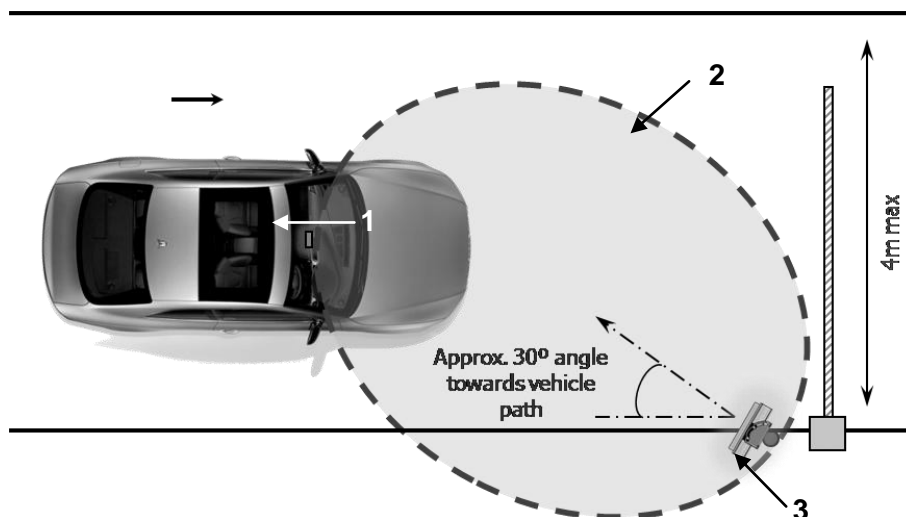
| 1	The tag, fastened on the windscreen respecting the antenna polarization axis. In that position, it's inclined between 30 to 45 degrees for an optimal alignment with the reader.
2	Theoretical identification zone
3	Reader. The reader should be positioned so that the pointing direction is about less than 30 degrees toward the vehicle direction.

The diagram above shows the best reader/tag orientation. In particular it avoids unwanted identifications in front of but far from the reader.

For best results, the tag surface and the reader surface should be parallel and reader's polarization axis should be same than tag's orientation. In this case, the tag reflects the maximum of the received signal.

When a tag is fixed to the vehicle windscreen, be aware of the presence of metalized areas (for heat reflection) which can degrade or prevent tag identification.

Contact BALOGH for recommendations on best practices for tag positioning..

2.3.2 INSTALLATION EXAMPLE: LATERAL IDENTIFICATION
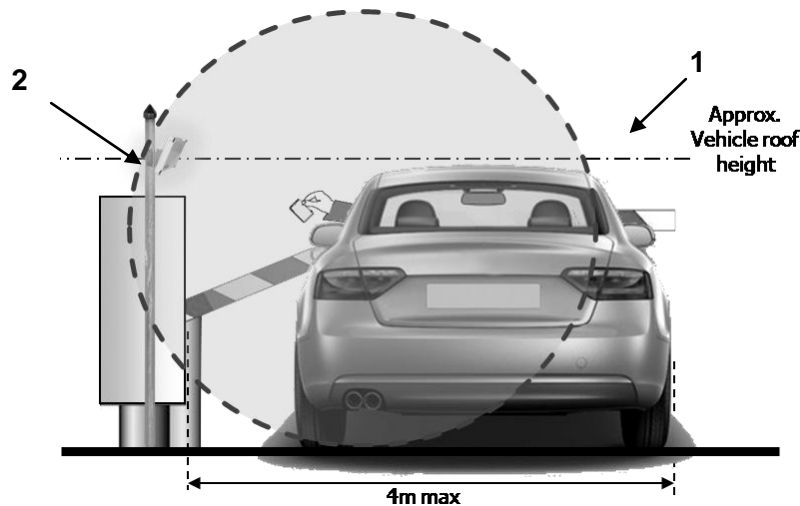
1	Theoretical identification zone
2	Reader. The reader should be positioned so that the angle is between about 0 and 20 degrees down towards the vehicle.
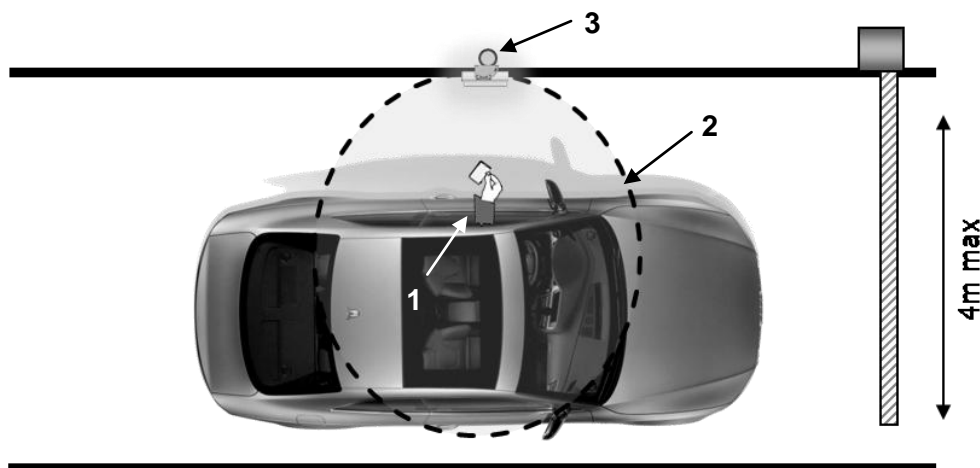
1	The tag, presented through lateral window in front of the reader and respecting the antenna polarization axis.
2	Theoretical identification zone
3	Reader. The reader should be positioned so that the pointing direction is about less than 30 degrees toward the vehicle direction.

The diagram above shows the best reader/tag orientation.
For best results, the tag surface and the reader surface should be parallel and reader's polarization axis should be same than tag's orientation. In this case, the tag reflects the maximum of the received signal.

When a tag is handily presented to a reader, take care on the manipulation, fingers can degrade or prevent tag identification. Contact BALOGH for recommendations on best practices for tag positioning.

3 ELECTRICAL CONNECTIONS

All the reader's connectors are found on the rear panel.
All connectors are panel mounts using the M12 standard.
Moulded cable assemblies are available as accessories.
Manual assembly cable connectors with screw-terminals are available as accessories.

ATTENTION: these M12 type connectors are designed for hand-tightening only. Spanners or pliers must not be used in order not to cause damage.

Connector numbers (rear view of MRU 688x)
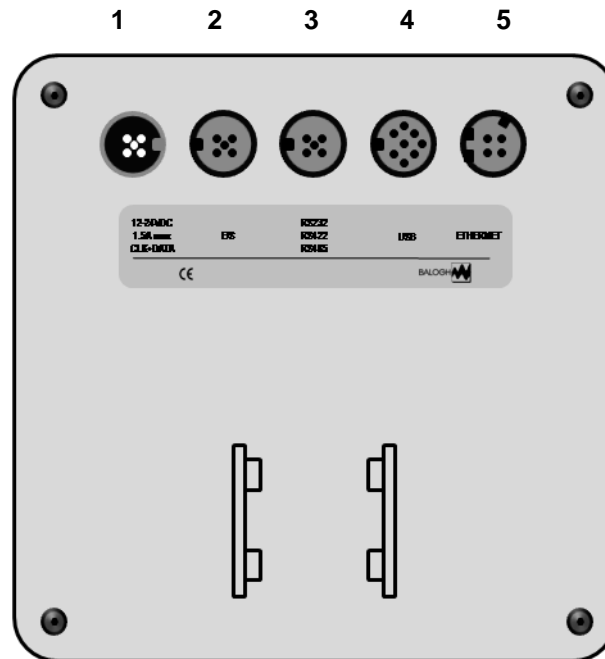
MRU 688x reader is equipped with several data interfaces.
These cannot operate simultaneously; only one at a time can be used.

Models MRU688x-RS and MRU688x-ETH are equipped with different serial data interfaces, respectively: USB, RS and USB, RS, ETHERNET.

These cannot operate simultaneously; only one at a time can be used. Selection is done automatically when cables are connected, according to the following priority:

USB > RS   or   USB > ETHERNET > RS

The USB interface has priority over the Ethernet or RS interface, so the USB cable must be removed in order to use the Ethernet or RS interface.
Similarly, the Ethernet interface has priority over the RS interface, so the Ethernet cable must be removed in order to use the RS interface.

Further information pertaining to the data interfaces described in this manual can be found in the MRU 688x Interface Manual (reference IM-MRU-x.y-EN)
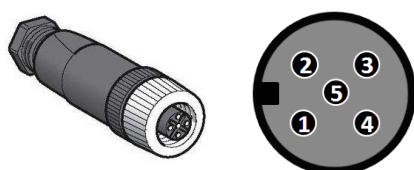
3.1 CONNECTOR N°1 : POWER SUPPLY & TTL INTERFACE

This connector has 2 functions: reader power supply and open collector interface for DATA/CLOCK and WIEGAND

Reader : M12 plug, A-coding, male, 5 pins.
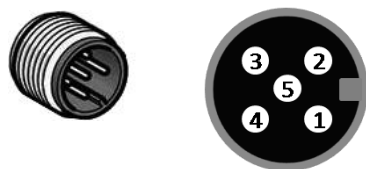
	POWER	COMMUNICATION	
		ISO2	WIEGAND
1	+DC		
2		DATA	DATA "0"
3		CLOCK	DATA "1"
4	0 V		
5		GND	GND

ACS 8320 : M12 connector, A-coding, female, 5 pins.

CBL M12F5P : 5m cable with M12 connector, female, 5 pins

	Color
1	Brown
2	White
3	Blue
4	Black
5	Grey *(*)*

(*) Grey or Yellow/Green

3.1.1 READER POWER SUPPLY

The reader requires a DC power supply of between 12Vdc and 24Vdc applied between pins 1 and 4 of the connector. The reader electronics are protected against polarity inversion for the power supply connection

Current drawn is 1.5 A maximum during power-up surge.

Average currents for steady-state operation are given in the following table:

+DC	TTL version	RS-ETH version
12V	530mA	580mA
24V	290mA	340mA

Pay careful attention to the length and gauge of the wire used.
Ohmic losses in the power lead can cause a voltage drop, make sure the input voltage to the reader is greater than 11.5V.

If the power supply cannot provide sufficient current during the power-up, the front-panel light will blink red. This is not a fault condition, but an indication that a better-dimensioned power supply must be used.

3.1.2 OPEN COLLECTOR LINK

Different signals appear on the pins depending on which interface is selected.

	ISO2	WIEGAND
2	DATA	DATA "0"
3	CLOCK	DATA "1"
5	GND	GND

For correct operation, pull-up (typical resistor value of 1KΩ) are to be connected to a voltage reference between +5Vdc and +12Vdc.
On most of access control dedicated controllers "pull-up" are already included; so adding external resistors to the data lines is not mandatory.
For correct operation, it is crucial pull-up voltage value measured at reader connector not to go under 4.2Vcc nor over 12.5Vcc to prevent any malfunctioning or the destruction of the reader.
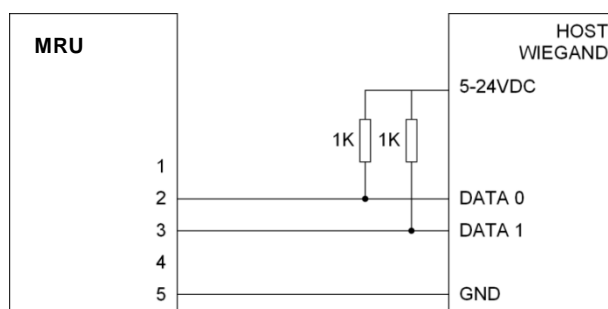
Circuit diagram for open-collector output:
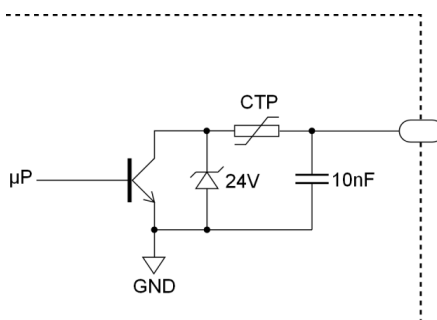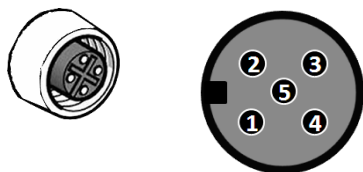

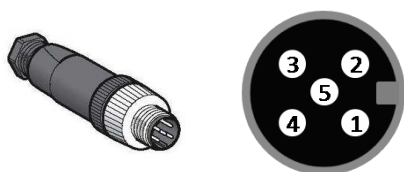**Reader connections for DATA-CLOCK:**
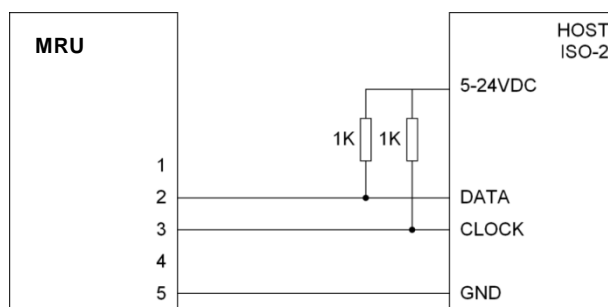
Reader connections for WIEGAND :

3.2 CONNECTOR N°2 : INPUT / OUTPUT

Reader : M12 plug, A-coding, female, 5 pins

1	E+	**INPUT**
2	E−	
3	SV	
4	S+	**OUTPUT**
5	S−	

ACS 8320 : M12 connector, A-coding, male, 5 pins

	Color
1	Brown
2	White
3	Blue
4	Black
5	Grey *(*)*

(*) Grey or Yellow/Green

CBL M12M5P : 5m cable with M12 connector, male, 5 pins

3.2.1 INPUT

Circuit diagram for digital input:
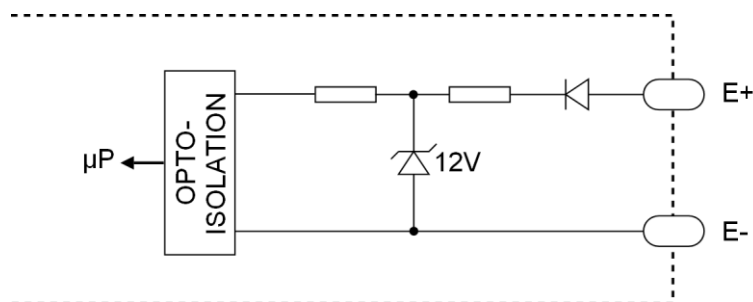
This input allows enabling or disabling tag reading, e.g. when a loop vehicle detector provides a control signal.
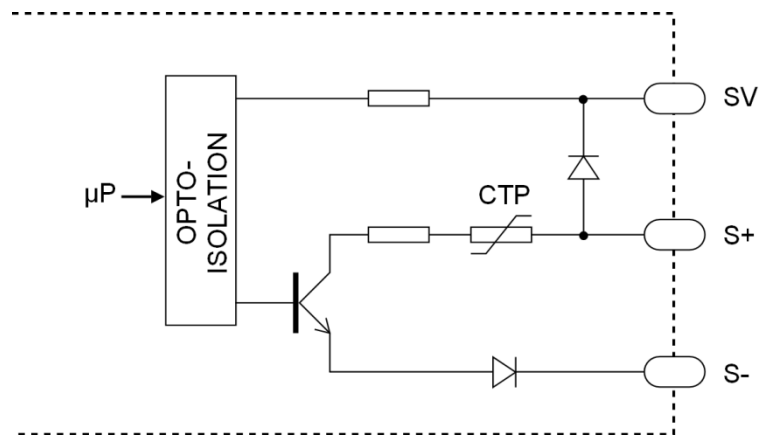
An open circuit or a positive voltage less than 4.4V applied to the pin E+ (E- to GND) will disable tag reading.
A voltage between 7.1V and 24V will enable tag reading.
For correct operation, it is crucial voltage applied to the input must not exceed 24VDC to prevent any malfunctioning or the destruction of the reader

3.2.2 OUTPUT

Circuit diagram for digital output:

This output is designed to control a 12V or 24V relay, a buzzer or a light indicator.
The drawn current is typically 100mA.

When activated the output turns on the internal transistor and current is drawn from the external voltage applied on the SV pin. The load is to be connected between pins S+ and SV.
The collector current will induce a voltage of about 1V between these two pins.
When output is disabled, the transistor is turned off and the voltage on pin S+ will be equal to that on pin SV.

Typical wiring diagram for connecting a buzzer or relay :
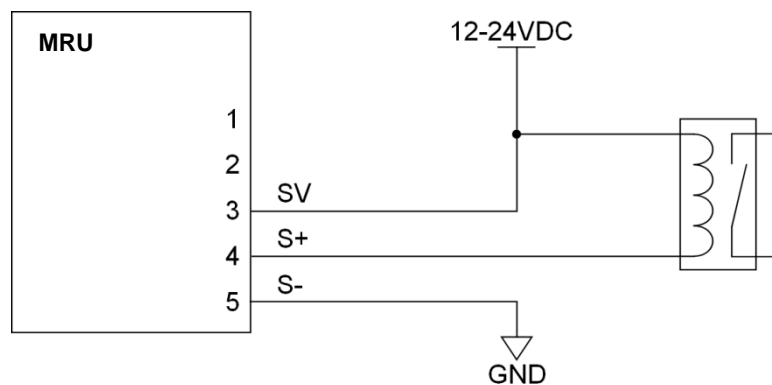
3.3 CONNECTOR N°3 : ASYNCHRONOUS SERIAL LINK

This connector is only available on MRU688x RS and MRU688x ETH models

Models MRU688x-RS and MRU688x-ETH are equipped with different serial data interfaces, respectively: USB, RS and USB, RS, ETHERNET.
These cannot operate simultaneously; only one at a time can be used. Selection is done automatically when cables are connected, according to the following priority:
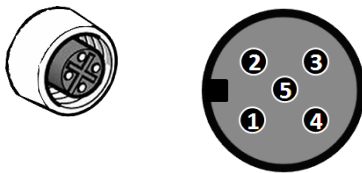
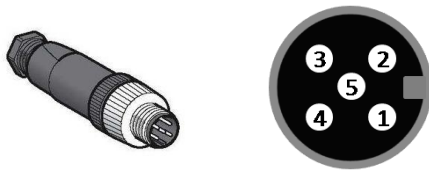**USB > RS**   or   **USB > ETHERNET > RS**

The USB interface has priority over the Ethernet or RS interface, so the USB cable must be removed in order to use the Ethernet or RS interface.
Similarly, the Ethernet interface has priority over the RS interface, so the Ethernet cable must be removed in order to use the RS interface.

Reader : M12 plug, A-coding, female, 5 pins

	RS-232	RS-422	RS-485
1	TX	TX+	V1+
2	—	TX–	V1–
3	—	RX+	V2+
4	RX	RX–	V2–
5	GND	GND	GND

ACS 8320 : M12 connector, A-coding, male, 5 pins

CBL M12M5P : 5m cable with M12 connector, male, 5 pins

	Color
1	Brown
2	White
3	Blue
4	Black
5	Grey *(*)*

(*) Grey or Yellow/Green

3.3.1 WIRING DIAGRAMS FOR HOST CONNECTIONS
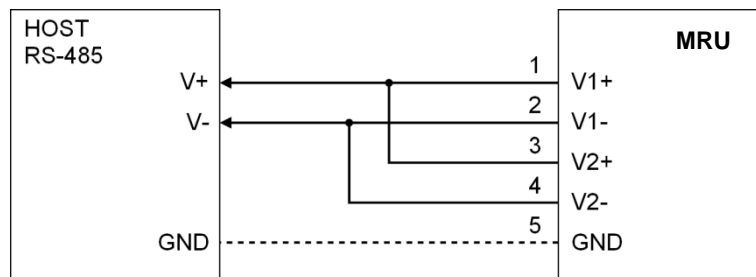
Reader connections for RS-232:

UM-MRU688x-1.0-EN
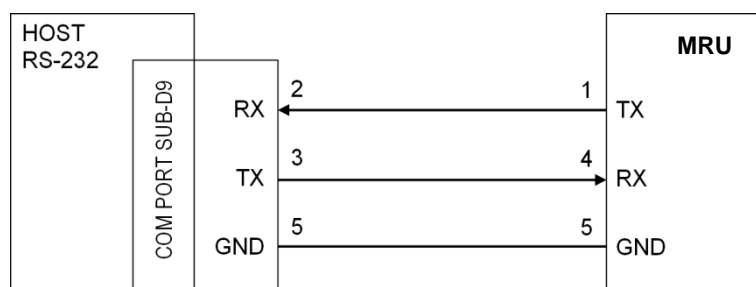
Reader connections for RS-422 (full-duplex):
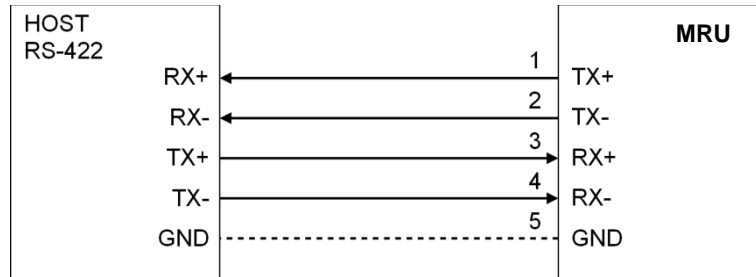
Reader connections for RS-485 (half-duplex):

3.3.2 ELECTRICAL CONNECTION

Cables to use for RS-422 and RS-485 links

> • In the absence of electrical noise - unshielded twisted pairs.
> • In a noisy environment - individually shielded twisted pairs

For short cable lengths, standard cables are satisfactory.
For cables longer than 100 m, high quality cables (low loss, low distributed capacity and resistance) should be used for all transmission speeds.

Signal inversions

For an RS-232 link, signal polarities and levels are well defined. On both devices RX is connected to TX and vice-versa.

For an RS-422 or RS-485 link, the signal "+" is normally at a high level at rest and active low, the reverse is true for the signal "–". This is the case for this reader. If however the differential signals are generated by a converter from an RS-232 interface, then the "+" line can be at a low level at rest and active high. In this case, the signals must be inverted.

Connection of GND

For an RS-232 link, the GND of each equipment must be at the same potential. Consequently, the signal GND (pin 5 on the connector) must be connected to the GND of the host equipment. For a differential link, this GND connection is not absolutely necessary but often recommended.

3.4 CONNECTOR N°4 : USB

Models MRU688x-RS and MRU688x-ETH are equipped with different serial data interfaces, respectively: USB, RS and USB, RS, ETHERNET.
These cannot operate simultaneously; only one at a time can be used. Selection is done automatically when cables are connected, according to the following priority:

USB > RS   **or**   **USB > ETHERNET > RS**

The USB interface has priority over the Ethernet or RS interface, so the USB cable must be removed in order to use the Ethernet or RS interface.
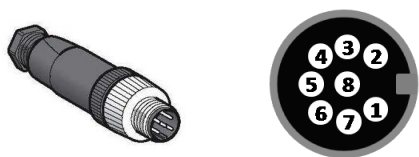Similarly, the Ethernet interface has priority over the RS interface, so the Ethernet cable must be removed in order to use the RS interface.

Reader : M12 plug, A-coding, female, 8 pins

ACS 8320 : M12 connector, A-coding, male, 8 pins
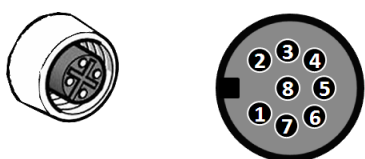
1	V USB (+5V)	
2	DATA-	USB
3	DATA+	
4	GND	
5	**Do not connect!**	
6	**Do not connect!**	
7	**Do not connect!**	
8	**Do not connect!**	

COR USB M12M8P : Pre-assembly USB cable 1.8m length

The MRU 688x reader feature an USB interface for service, installation and firmware update purposes.
The USB interface can be used to configure the reader using MODBUS commands, a freeware is also available, ask BALOGH.

Communication with the reader over USB is done using a virtual COM port and the appropriate driver must be installed.

Download the appropriate driver from the FTDI's website at www.ftdichip.com/Drivers/VCP.htm

Further information pertaining to the data interfaces described in this manual can be found in the MRU 688x Interface Manual (reference IM-MRU-x.y-EN).

3.5 CONNECTOR N°5 : ETHERNET

This connector is only available on MRU688x ETH models

MRU688x-ETH models are equipped with different serial data interfaces : USB, RS, ETHERNET.

These cannot operate simultaneously; only one at a time can be used. Selection is done automatically when cables are connected, according to the following priority:

USB > ETHERNET > RS

The USB interface has priority over the Ethernet or RS interface, so the USB cable must be removed in order to use the Ethernet or RS interface.
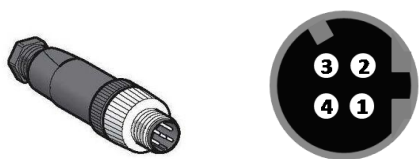
Similarly, the Ethernet interface has priority over the RS interface, so the Ethernet cable must be removed in order to use the RS interface.

Reader : M12 plug, D-coding, female, 4 pins
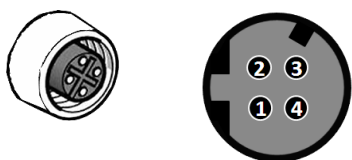
1	T+
2	R+
3	T−
4	R−

ACS 8320 : M12 connector, D-coding, male, 4 pins

CBL M12M5P : Pre-assembly RJ45 cable 5m length

The MRU 688x-ETH model features an ETHERNET interface.

This interface allows connecting the reader to an Ethernet network with a standard RJ45 connector at the host end.

Only the MODBUS RTU protocol is implemented. Therefore the application data transmitted over the TCP socket must be MODBUS RTU frames. The interface component performs neither conversion nor interpretation.

Communication with the reader over Ethernet is done using a virtual COM port just as for a serial interface and the appropriate driver must be installed.

Download the appropriate driver from the LANTRONIX's website at
http://www.lantronix.com/support/downloads/?p=CPR

Further information pertaining to the data interfaces described in this manual can be found in the MRU 688x Interface Manual (reference IM-MRU-x.y-EN).

4 SERVICE OPERATION

4.1 OPERATION OF THE INDICATOR LIGHT

The indicator light on the reader conveys the reader's behaviour to the user. It is the only visible part of the system. It is controlled by the embedded reader software. It can also be put under host control using appropriate MODBUS commands via a serial link.

During the initialization phase, the light is a fixed red. If the initialization is successful, the indicator light starts to flash green; otherwise it flashes red very slowly.

If after power-on the light flashes quickly, this is usually caused by a power supply problem, either voltage or current insufficient. This is not a fault condition, but an indication that a better-dimensioned power supply must be used.

During the reading of a tag, the indicator light goes out for one second, and then resumes green flashing.

4.2 READER SETTINGS

Reader is normally pre-configured at delivery according to element given at order.

It's possible to modify the reader' settings by means of specific ModBus commands.
Using ModBus commands can be done anytime at the express condition the reader communication interface has been correctly configured.

Further information pertaining to the reader configuration described in this manual can be found in the MRU 688x Interface Manual (reference IM-MRU-x.y-EN).

4.3 FREQUENCY SETTINGS

No frequency adjustment is required for MRU 688x reader

Fully compliant to EN 302208 norm, this reader uses an automatic frequency allocation mode called « LBT » (=Listen before talk).

In this mode, the reader automatically allocate its frequency settings using one of the available channel 4, 7, 10 or 13, for complete description refer to the corresponding norm.

This mode allows using the reader at the maximum of its power emission.

5 MAINTENANCE

5.1 PERIODIC MAINTENANCE

The MRU688x reader requires no periodic maintenance

The reader should be regularly cleaned in order to avoid dust and dirt accumulating on the case.

The reader should be regularly checked for:
* cracks in the case
* missing mounting screws
* screws correctly tightened
* connectors correctly locked

5.2 REPLACEMENT

If the MRU688x needs to be replaced, the procedure is as follows:

* Turn the knurled ring of the plugs anti-clockwise to unlock the connectors.
* Record the reader orientation (azimuth and elevation), then remove the mounting screws and dismount the unit.
* Place the new unit in the same position, insert the mounting screws and tighten correctly.
* Replace connectors and for each turn the knurled ring clockwise until locked.

ATTENTION: these M12 type connectors are designed for hand-tightening only. Spanners or pliers must not be used in order not to cause damage.

5.3 RECYCLING

All decommissioned readers must be returned to BALOGH SA for appropriate recycling according to directive D3E.

6 LEGAL INFORMATION

6.1 CE NOTICE

DECLARATION OF CONFORMITY

CE 0536

BALOGH Toulouse
105 Avenue du Général Eisenhower
31023 TOULOUSE cedex 1
FRANCE

This declaration certifies that the MRU reader satisfies the essential requirements of the European directive R&TTE 1999/5/EC aiming to align the laws of the Member States relating to the use of the electromagnetic spectrum, electromagnetic compatibility and electrical safety.

This declaration applies to all readers manufactured according to the technical specifications outlined in Annexe II of the directive. Evaluation of the conformity of the equipment with the essential requirements article 3 R&TTE has been done in accordance with Annex IV of the directive and the following standards:

Radio spectrum:	EN 302 208
EMC:	EN 301 489-1 and -3
Electrical safety:	EN 60 950
Exposure to electromagnetic fields:	EN 50 364

6.2 LABEL ON REAR PANEL

6.3 TECHNICAL CHARACTERISTICS AND DIMENSIONS

Radio-frequencies : ISO 18000-6 type C et EN302 208
  • Frequency band: 865-868MHz
  • Built-in antenna gain : 4dBi
  • Power emitted: Adjustable up to 2W ERP
Power supply
  • Voltage range: 12 - 24 Volts DC
  • Current: 1.5A max
Environmental conditions
  • Relative humidity: 90% non-condensing
  • Storage temperature: -25° to +80° C
  • Operating temperature: -20° to +50° C
Protection class
  • IP65
External dimensions
  • Length: 186mm   • Width: 186mm
  • Thickness: 33mm/58mm   • weight: 1,8 kg
Connections available
• Wiegand 26bits, DATA/CLOCK (magnetic stripe ISO 7811-2), RS 232, RS 422, RS485, USB, ETHERNET (interfaces available depending on model)