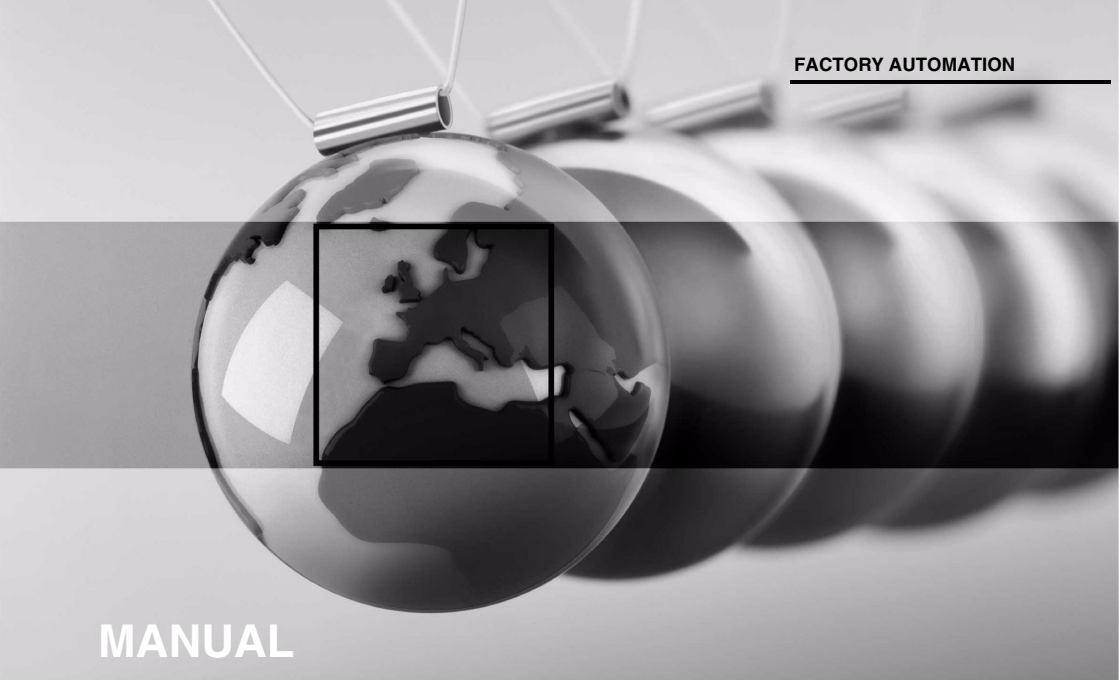
FACTORY AUTOMATION



MANUAL

MTT3000-F180-B12-V45-MON

System MT

CE

PEPPERL+FUCHS
SENSING YOUR NEEDS

With regard to the supply of products, the current issue of the following document is applicable: The General Terms of Delivery for Products and Services of the Electrical Industry, published by the Central Association of the Electrical Industry (Zentralverband Elektrotechnik und Elektroindustrie (ZVEI) e.V.) in its most recent version as well as the supplementary clause: "Expanded reservation of proprietorship"

1 Introduction

Congratulations

You have chosen a device manufactured by Pepperl+Fuchs. Pepperl+Fuchs develops, produces and distributes electronic sensors and interface modules for the market of automation technology on a worldwide scale.

Before installing this equipment and put into operation, read this manual carefully. This manual containes instructions and notes to help you through the installation and commissioning step by step. This makes sure bring such a trouble-free use of this product. This is for your benefit, since this:

- ensures the safe operation of the device
- helps you to exploit the full functionality of the device
- avoids errors and related malfunctions
- avoids costs by disruptions and any repairs
- increases the effectiveness and efficiency of your plant

Keep this manual at hand for subsequent operations on the device.

After opening the packaging please check the integrity of the device and the number of pieces of supplied.

Symbols used

The following symbols are used in this manual:

Note!

This symbol draws your attention to important information.

Handling instructions

You will find handling instructions beside this symbol

Contact

If you have any questions about the device, its functions, or accessories, please contact us at:

Pepperl+Fuchs GmbH
Lilienthalstraße 200
68307 Mannheim
Telephone: +49 621 776-4411
Fax: +49 621 776-274411
E-Mail: fa-info@pepperl-fuchs.com

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2 Declaration of conformity

2.1 Declaration of Conformity

All products have been developed and manufactured taking into consideration applicable European standards and regulations.

Note!

A Declaration of Conformity can be requested from the manufacturer.

The manufacturer of this product, Pepperl+Fuchs GmbH in 68307 Mannheim, Germany, has a certified quality assurance system in conformity with ISO 9001.

ISO**9001**

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3 Safety

3.1 Symbols relevant to safety

Danger!
This symbol indicates a warning about a possible danger.

In the event the warning is ignored, the consequences may range from personal injury to death.

Warning!
This symbol indicates a warning about a possible fault or danger.

In the event the warning is ignored, the consequences may course personal injury or heaviest property damage.

Caution!
This symbol warns of a possible fault.

Failure to observe the instructions given in this warning may result in the devices and any connected facilities or systems develop a fault or fail completely.

3.2 General notes on safety

Only instructed specialist staff may operate the device in accordance with the operating manual.

Independent interventions and separate modifications are dangerous and will void the warranty and exclude the manufacturer from any liability. If serious faults occur, stop using the device. Secure the device against inadvertent operation. In the event of repairs, send the device to Pepperl+Fuchs.

The connection of the device and maintenance work when live may only be carried out by a qualified electrical specialist.

The operating company bears responsibility for observing locally applicable safety regulations.

Store the not used device in the original packaging. This offers the device optimal protection against impact and moisture.

Ensure that the ambient conditions comply with regulations.

Note!

Disposal

Electronic waste is hazardous waste. When disposing of the equipment, observe the current statutory requirements in the respective country of use, as well as local regulations.

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4 Product description

4.1 General Information about the System

This chapter gives you an overview over the whole Ident-M System T. It illustrates the identification system with its components in general and the readers in particular. Environmental considerations as well as technical data are also described.

4.2 ID-Tags

An ID-tag is a battery-assisted passive 2.45 GHz RFID tag. It carries ID information that can be read at a long distance using radio frequencies. The actual reading range depends on reader type, ID-tag type, reader configuration settings and environmental conditions. Every ID-tag has a unique and permanent identification number called ID-tag fixcode. Many ID-tags can be read concurrently. A lithium cell is used in the ID-tag to preserve stored data, and get a high communication speed. There are two general types of ID-tags called MTM-Tags and MTO-Tags. MTM´s can both be read from and written to, while MTO`s only can be read. The data stored in a MTO-tag includes the ID-tag fixcode. The data stored in a MTM-tag includes the ID-tag fixcode and a writable data field called ID-tag user data. The data in an ID-tag includes a 32-bit checksum for automatic verification. The reader does not report ID-tag readings containing invalid checksums. Only valid ID-tag data is reported in order to increase the system and application software security.

The system MT reader is capable of communicating with all Pepperl+Fuchs ID-tag formats, which include the following formats:

- Read only
- Read and write
- High or low data speed
- Random and constant mode
- ID-tags with mini-, quarter-, or full-memory data sizes

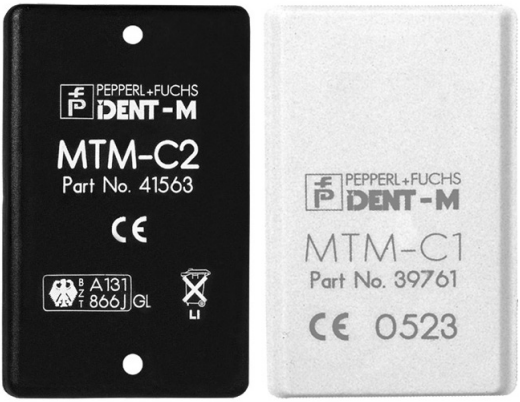

Figure 4.1: R/W-tag, heavy duty & standard

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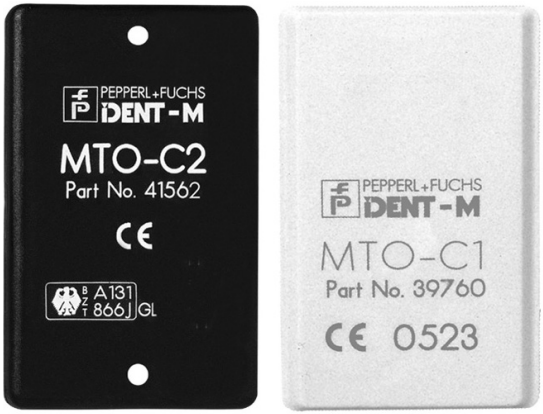

Figure 4.2: Read only tag, heavy duty & standard

The front side of the ID-tags must be oriented towards the front side of the reader. For maximum communication range, the front surface of the ID-tag should be parallel with the front side of the reader. If the ID-tag is misaligned relative to the front side of the reader, the communication range is reduced.

4.2.1 MTM-C1

This programmable credit card ID-tag can be used for many different applications in access and logistics. The ID-tag has some user memory and several format and mode options. The user memory can store up to 606 bits, corresponding to 71 8-bit ASCII characters and a 32 bit data checksum. Each tag is also permanently programmed with an 8 digit decimal “mark”. Every "mark" is unique and can only appear on one single tag. The patented programmed tag checksum eliminates any “mark” and user memory reading errors even if the tag is far away or if several tags are present in the same reading zone.

The tag can be formatted for several different operating modes by the reader. The programming options include memory size, response interval, response type (random or constant interval) and data speed. A status register for formatting and battery level monitoring is included. A backup memory holds the old data, to be read at any time, also in case the write process failed. The tag can be mounted on metal without affecting any read range properties. A lithium energy cell gives a long predictable life independent from the number of times the tag is read. If the capacity is about to run out after several years of operating life, a status bit is set to give the user a warning via the reader. When the status bit is set, the tag will continue to function for about six months. The design is vibration resistant, watertight, corrosion free, UV stable and withstands most chemicals. The front panel is made from a polymer that can be printed according to user requirements. The back panel is equipped with the part number and a serial number.

The …–C1 tags can be fitted by using a standard credit card holder or one of the holders provided by Pepperl+Fuchs. For windshield attachment e.g. we recommend the MTA-C1V2 with an adhesive tape. For permanent attachment by screws or by clip the MTA-C1V1 can be used.

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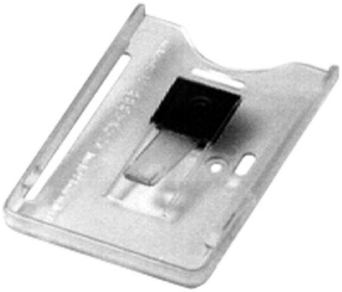

Figure 4.3: MTA-C1V2

Figure 4.4: MTA-C1V1

For special tagholders, like rubber units with suction cup attachment, ask Pepperl+Fuchs for possible solutions.

Figure 4.5: MTA-C2V3

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4.2.2 MTO-C1

This versatile credit card ID-tag can be used for many different applications in access and logistics. The front- and backsides are available for custom prints. The ID-tag is read-only and permanently programmed with an 8 digit decimal fixcode “Mark”. Every fixcode is unique and can only appear on one single tag. The programmed code includes a 32 bit checksum for automatic “mark” validation. The patented preprogrammed tag checksum eliminates any “Mark” reading errors even if the tag is far away or if several tags are present in the same reading zone.

4.2.3 MTM-C2(The MTT3000... can read these tags but can't write them)

The MTM-C2 comes in a robust housing for heavy duty and industrial use. It is specially designed for tough environments and high temperatures. Typical applications are indoors in heavy industry like skids and car bodies or outdoors mounted on sea containers, trains, trams, buses, trucks and lorries. It can be mounted on any surface with M4 screws. It communicates via the 2,45 GHz frequency and stores 606 bits, including a 32 bit checksum, e g as 71 8-bit ASCII characters. A factory coded 8 decimal digit "mark" and a separate 32 bit checksum give the tag a unique and substitution safe identity. The tag can be formatted into different operating modes regarding memory size, response interval/type and data speed. A status register for memory and lithium cell monitoring is included. If the MTM-C2 exits the write zone during programming, a "failed write" bit is set to warn the user. The old data is restored from a backup memory.

Environmentally harmless lithium cell powering gives long reading range, high reading speed and multitag possibility. The cell life depends on the mode the tag has been formatted, but is independent from how often it is read. The cell life is not influenced from exposure to electrically noisy environments. When the capacity is about to run out, the status register warns via a "battery low" bit. The design is vibration resistant, watertight, corrosion free, UV stable and withstands chemicals. The front side can be printed according to user requirements. The rear side label is printed with type code and serial number.

4.2.4 MTO-C2

The MTO-C2 is the fixcode version like MTO-C1, but with the same industrial housing as the MTM-C2.

4.2.5 Read Range

An MTM-.. tag receives its signals through the front panel. The tag can not be read or programmed towards the backside. The read range is defined by a number of factors such as the position the reader and the tag. The read range also depends on the reader model and settings as well as the environment. The tag can be read using any rotational angle as long as the front side is turned towards the reader.

The ID-tag will be read at any distance from the reader up to the maximum read distance. The read range shown in the identification lobe diagrams below indicates the typical read range for near 100% reading probability in an ideal environment with maximum read level:

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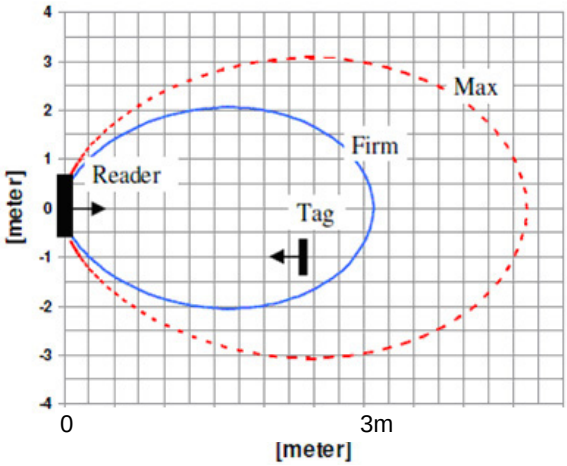
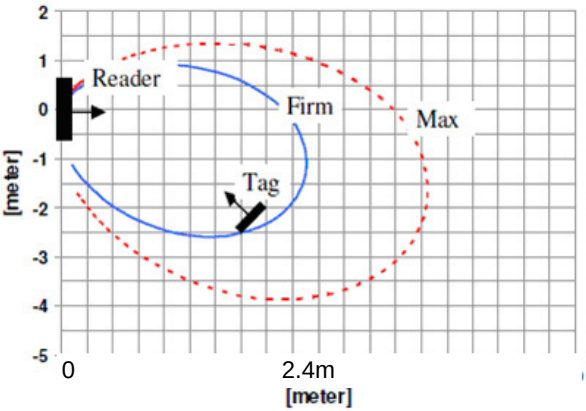


If the tag is tilted 45° vs. the reader the read range will be transformed according to the diagram below:



The lobe is unaffected if the tag is mounted on a metal surface. Non metallic materials in front of the tag usually have little effect on the read range lobe. The diagrams show the typical MTM-C1 read range properties for an average of all available frequency channels in an ideal environment. Any excess read range can easily be reduced by setting the readers read level. If the read level function is used, very accurate identification lobes can be defined. The difference between the firm and the maximum read range can be minimized.

4.2.6 Write Range(The MTT3000-F180-B12-V45-MON can't write!)

A detection circuit forwards programming signals from the reader to the tag memory. Using the MTT6000-F120-B12-V45 with an emitted power of 10mW EIRP, the write range is typically 0.25 meters. The tag can be programmed at all distances up to the maximum write range.

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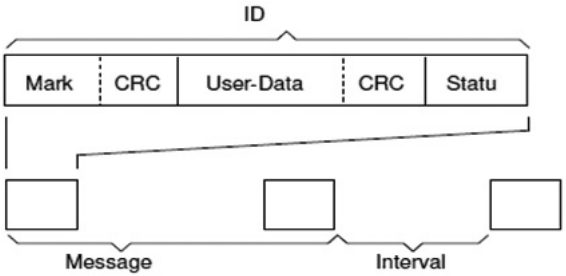
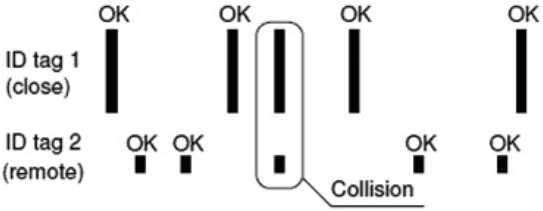
4.2.7 Communication

The ID-tag will supply the tag information to any interrogating reader set to any frequency (channel) within the frequency band. If different readers are set to different channels and simultaneously illuminate the tag, the tag will be safely read by all of these raeders without interference.



The tag generates “ID frames” with either constant or random intervals. The time for two subsequent “ID frames” with an interval in between is called a "message time". When the MTM-C1 is set to “random interval mode”, it is possible to read several tags at the same time as shown in the picture below:



When collisions occur, the checksum algorithm in the reader will cancel any faulty “ID mark” readings. In the example above however, the “ID tag 1” will be correctly identified, since the tag is closer to the reader. In a worst case situation, e.g. if all tags would be remote and close to the read range limit or subject to strong interference, the likelihood for a reading error (wrong interpretation) is less than one in 5.E+9 (5 000 000 000) readings, thanks to the 32 bit CRC checksum. In all practical cases the reader will always provide the correct information. The MTM-.. tags can be programmed for different “interval lengths modes”: 0, 4, 8 or 16. (i.e., the multiple of the “ID frame” time length minus 1.) During the interval the tag is silent which allows other tags to talk. When set to “random interval mode” the "interval length” setting is the average number of intervals that will appear. The actual interval can be anything between 0 and twice the interval length setting. The fixcode tags MTO-C1 and MTO-C2 are preset to a random interval length of 8, high speed. This setting can not be altered. An interval plus leading and trailing ID-frames is called a "message time". The “message time”, i.e. the longest time required for a complete ID-frame to be read, is always less than 150 ms. The average time is 80 ms which means that the a tag is read 12 times every second.

Tags in zone	Average [ms]	Comfort 99% [ms]	Safe 99,9% [ms]
2	200	600	800
3	350	1000	1400
4	500	1400	2000

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The time required to read several tags in “random mode” depends on the number of tags present in the read lobe at the same time. The following table applies for a tag formatted to MR4H, i.e., **M**ini memory, **R**andom interval **4** and **H**igh speed. (see chapter 4.2.8 for detailed definitions).

4.2.8 Operating modes

The tag can be set to different operating modes by write commands. Parameters affected are memory size, interval type, interval length and data speed.

Memory modes

Mini	14bit user data (1 ASCII) + 32b CRC
Quarter	154bit user data (19 ASCII) + 32b CRC
Full	574bit user data (71 ASCII) + 32b CRC

Interval type modes

Constant	i.e. interval is constant between ID frames
Random	i.e. interval is varying randomly

Interval length modes

0	zero: continuous
4	short: 4 times the ID frame time
8	medium: 8 times the ID frame time
16	long: 16 times the ID frame time

Data speed modes

L	low: reading 4 kbps, writing 4 kbps
H	high: reading 16 kbps, writing 4 kbps

Possible modes are: MC0L, MR4H, FC0H etc.

Modes are feasible in all combinations.

4.2.9 Tag reading

The table shows the maximum message time, i.e. the total time for two ID frames and an interval.

Message time vs. data speed

Mini memory	High speed [ms]	Low speed [ms]
MC0-H/L	45	130
MC4-H/L	80	320
MC8-H/L	145	560
MC16-H/L	270	960

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4.2.10 Tag writing(The MTT3000-F180-B12-V45-MON can't write!)

The write time depends on the tag operating mode and a statistical time distribution. The tables below lists the time it takes to program the tag for different modes. Some fields are left blank to indicate that the mode is too slow and is therefor not recommended. The 99% column represents 99 times out of 100 success.

High speed	Average [ms]	99% [ms]	99.999% [ms]
Mini memory:			
MC0H	200	300	600
MC4H	300	400	800
MC8H	300	900	2100
MR4H	300	900	2100
Quarter memory:			
QC0H	300	400	800
QC4H	500	1000	2300
QC8H	500	1900	4800
QR4H	500	1800	4500
Full memory:			
FC0H	400	1300	3000
FC4H	800	2600	6000
FC8H	1700		
FR4H	1300		

Low speed	Average [ms]	99% [ms]	99.999% [ms]
Mini memory:			
MC0L	300	600	1400
MC4L	500	1200	2800
MC8L	900	2600	6000
MR4L	800	2700	
Quarter memory:			
QC0L	500	1300	2900
QC4L	1000	2900	
QC8L	2400		
QR4L	1800		
Full memory:			
FC0L	1100	3200	
FC4L	2500		

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A backup function is provided for the case that the tag is taken of of the write zone by accident while it receives data from the reader. The old data is automatically restored from the tag backup memory and a "failed write" flag is set in the status register to give automatic warning to the user system.

4.2.11 Tag life

The lithium cell is specified for high and low temperature operation, e.g. the tag is installed in a car window. The operating temperature is the key to predict the operating life of the tag.

The interval length also affects the power consumption and battery life since the tag consumes less power when it is inactive. The theoretical battery life performance for different constant temperatures and different interval lengths can be found in the diagram below. The diagram does not represent the tag life in terms of average temperatures. Note that batteries are not specified beyond 10 years operation.

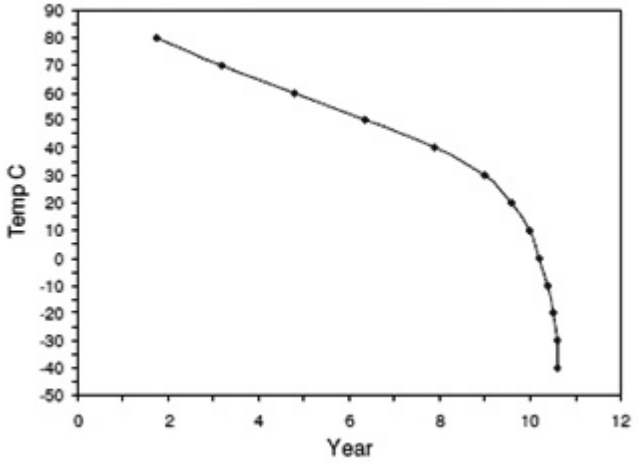

Figure 4.6: Calculated battery live time MTO-C1

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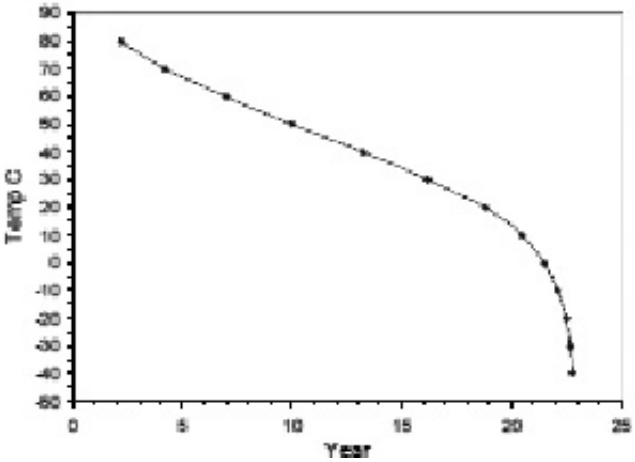

Figure 4.7: Calculated battery live time MTO-C2

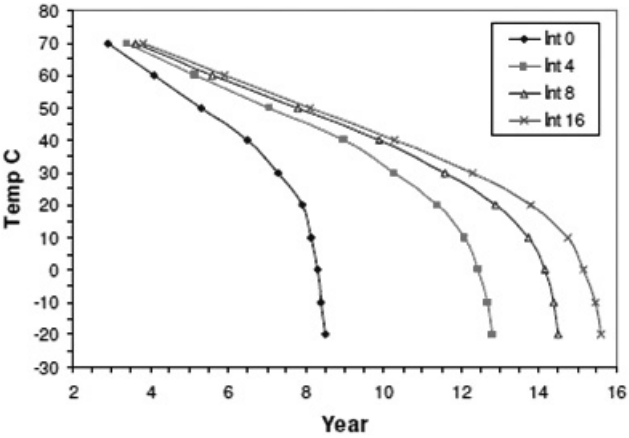

Figure 4.8: Calculated battery live time MTM-C1 & MTM-C2, depending on interval setting

4.2.12 Security

For security reasons, the serial number which is printed on the tag has no relation to the 8 digit decimal electronic “mark“ stored in the memory of the tag. Both are running numbers that are never repeated. The “mark” is unique and is set at the semiconductor manufacturing level and can not be changed. The serial number and “mark” information is only supplied to the specific customer.

4.3 Reader Overview

The 2.45 GHz frequency band can be used in most countries at low output power level without any specific site licence. This enables easy installation in a wide range of applications all over the world.

The reader can be connected to a host computer using the standard serial communication interfaces RS232 and RS485. The reader can also be connected through ethernet via a TCP/IP communication. The TCP/IP network functionality of the reader enables remote operation and maintenance. The reader can also be operated completely stand-alone using the built in database that stores the approved ID-tag identities. Events registered by the reader are time stamped using a battery-backed real time clock. A temporarily connected PC is used to configure the settings of the reader. The configuration is performed using either a standard webbrowser or terminal emulation software, depending on the chosen reader application software. In this type of configuration the reader can handle input signals from any sensor like mechanical switch, proximity switch, ultrasonic or optical sensor. For more information about our sensor products please contact Pepperl+Fuchs.

The system MT reader is a device for reading ID-tags using 2.45 GHz frequencies. In addition to reading, it also has the capability to write information to MTM-tags. The reader has built in antennas for communication with ID-tags as well as various serial interfaces for communication with a host computer. It is designed for configuration with a wide range of input and output devices, including relays, isolated I/O, indicators, and a buzzer. The reader is using the 2.45 GHz radio frequency. The usable frequency band includes 93 frequency channels. To reduce the risk of interference, several readers in close proximity to each other are set to different frequency channels. Readers can use frequency hopping when one specific frequency is not determined. The reader has several communication alternatives and is easily integrated using the following communication interfaces:

- Ethernet
- RS232
- RS485
- USB host
- Wiegand/Mag-stripe
- Micro SD memory card

Note!

The current reader application software does not support the use of all these interfaces. Any of these interfaces can be implemented in a customer-tailored application software. Please contact Pepperl+Fuchs for further information.

The reader is powered with a voltage ranging from +10 to +30 Volt DC.

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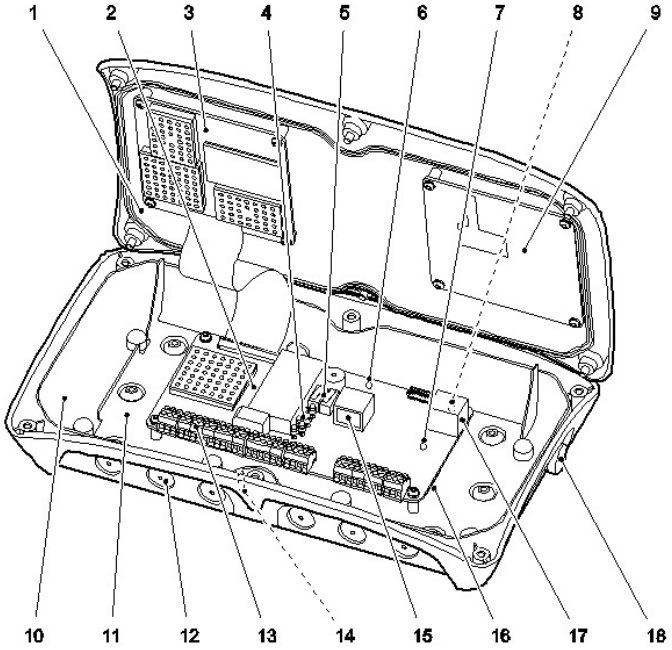

Figure 4.9: Overview of the Reader

1. Lid
2. Controller board
3. RF-unit
4. Externally-visible indicators
5. Tamper switches
6. Red system status indicator
7. Green system status indicator
8. Yellow system status indicator
9. TX-unit
10. Enclosure base
11. Chassis
12. Knock-out for cable entry
13. Terminal blocks
14. Ground screw
15. Ethernet connector with link state and activity indicators
16. Micro SD slot
17. USB host connector (intended for internal expansion)
18. Pressure balance membrane

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4.4 Functional Block Diagram

The picture below shows a functional block diagram of a Pepperl+Fuchs system MT reader.

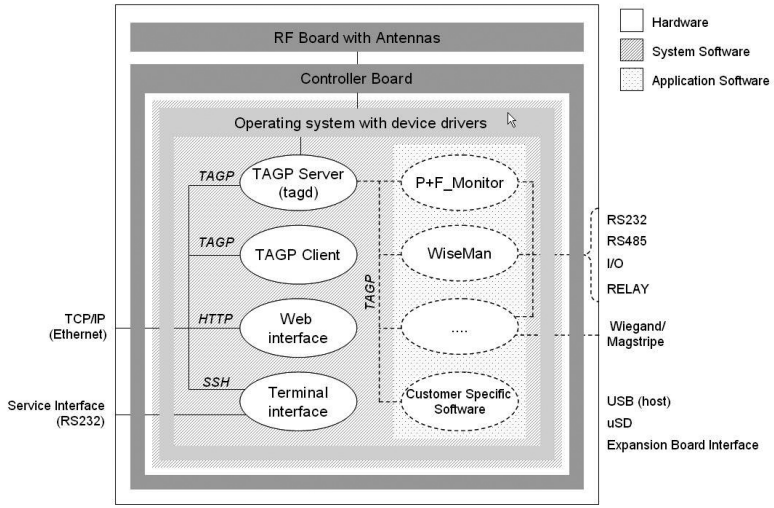

Figure 4.10: Functional block diagram of the Pepperl+Fuchs system MT reader

The reader can be divided into three major blocks:

Hardware

- The reader hardware consists of a controller board with general interfaces and an RF board with antennas. For the hardware: see chapter 4.5. For the interfaces: see chapter 4.8

System Software

- The reader's system software includes an operating system and a set of device drivers, libraries and applications. A TCP server implements a protocol called TAGP. This protocol is used by reader-hosted or remote applications to control all RFID functionality of the reader. A TAGP client provides TCP client functionality. General services include a web interface and a terminal interface. The system software is described in detail later.

Application Software

- Application software is optional software that adds application specific functionality to the reader. Customer tailored software can be realised, adapted to special needs for certain applications. Please contact Pepperl+Fuchs for further information.

4.5 Hardware

On a general level, the reader hardware consists of two physical building blocks, which are the RF-block and the controller board.

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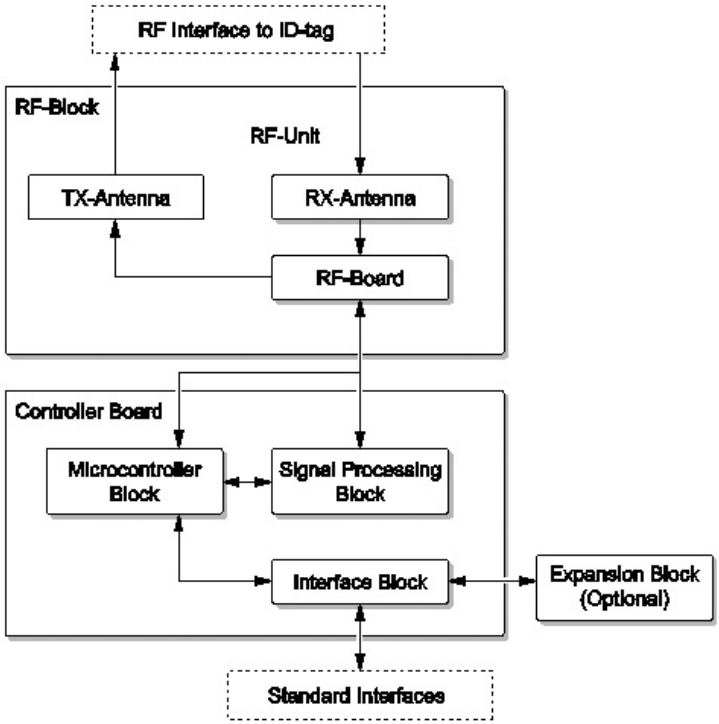

Figure 4.11: Hardware architecture overview

The RF-block and controller board subsequently consist of several other blocks. The building blocks constitute the reader platform on which different reader products are based. Each building block is described in the subsections below.

4.5.1 Controller Board

The controller board is the main component of the reader. The controler board controls the behaviour of the reader. It is conceptually divided into a microcontroller block, a signal processing block and an interface block.

Microcontroller Block

The microcontroller block is built around a **m**icro**c**ontroller **u**nit (MCU) from Atmel, the AT91RM9200 MCU with an ARM9 CPU core. The microcontroller block has flash memory, SDRAM memory, and a realtime clock with battery backup.

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Memory	Size	Description
RAM	32 MB	Volatile memory
Flash memory	16 MB	Holds all software. Is accessed via the **j**ournaling **f**lash **f**ile **s**ystem version **2** (JFFS2)

Table 4.1: Controller board memory

Signal Processing Block

The signal processing block on the controller board receives radio signals from the RF-board. The signal processing block performs analogue filtering and analogue to digital conversion. The digitally converted signal is fed to a **f**ield **p**rogrammable **g**ate **a**rray (FPGA), which filters the signal digitally and decodes the ID-tag data.

Interface Block

External devices can be connected via several standard communication interfaces to the interface block on the controller board. System MT readers are also provided with two USB host interfaces and an SD memory card slot. These Interfaces make it possible to add additional hardware and storage media. These options can be used in a customer tailored application firmware. For more information please contact Pepperl+Fuchs.

4.5.2 RF-block

The RF-block is the radio interface. It is primarily used for communication with ID tags. The RF-block consists of an RF-board with an RX-antenna and a TX-antenna.

The RF-block is controlled by software (i.e. frequency, attenuation, amplification, output power). This is sometimes referred to as **s**oftware **d**efined **r**adio (SDR).

A reader can be set to a radio frequency within the operating frequency band. Two readers set to different frequencies will not interfere, even if installed in close proximity of each other. It is recommended to use a frequency separation of at least 500 kHz between two adjacent readers.

Reader models prior to system MT use a frequency channel allocation scheme that divides the frequency band into distinct channels separated by 300 kHz. System MT based readers are backwards compatible with the previous channel frequency allocation scheme to facilitate integration with installations of older revision readers. See section 6.5 for information about the channel/frequency mapping. Frequency hopping is also available with the system MT reader, see chapter 4.9.2

4.6 System Software

The system software consists of an operating system and a set of device drivers, libraries and applications. All system MT readers have the system software installed by default.

4.6.1 Operating System

The operating system in the reader is based on the Linux kernel and other open source components. The Linux kernel includes device drivers for standard interfaces such as RS232, RS485 and Ethernet.

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4.6.2 TAGP Client

The TAGP client complements the TAGP server with TCP client functionality. It automatically connects to a specified TCP server (IP address and port) as soon as there is data to send. If the server is unavailable, the TAGP client buffers the data until the server is available again at which time the TAGP client automatically reconnects.

4.7 Application Software

Application software can be one of the Pepperl+Fuchs applications or a customer specific application written by Pepperl+Fuchs or the customer. The reader application software determines how the reader can be configured, how it operates and how it communicates with the system to which it is connected.

See the table below for a software overview and comparison between different reader application software. Note that software features might be subject to change or available only as options. Some optionally available Reader application software can be delivered by Pepperl+Fuchs.

It is also possible to order a customer-specific software, tailored to the demands of a certain application. Please ask Pepperl+Fuchs for more information.

4.7.1 P+F_MONITOR

The MTT3000-F180-B12-V45-MON includes a Pepperl+Fuchs specific monitor software as standard application software. This software has been designed to fit specific needs of many customers. It can be configured for 4 different modes of operation (see chapter Application Software P+F_MONITOR for detailed information). It supports the communication both via Ethernet TCP/IP and Serial Interface as well as the usage of certain I/Os. New devices are delivered starting this application software as default. In this case the main indicator shows a green light.

4.7.2 WiseMan

The WiseMan software is used in identification systems that require a reader with both information storage and decision-making capabilities. With this option the reader will behave like the predecessor readers of this system, the MTT-S1 units.

A reader installed with WiseMan can operate stand-alone. An alternative to using the reader stand-alone is to control the reader from a host computer and place some or all of the functionality externally into the host. The communication between the WiseMan software and the host application software is done via a serial communication interface.

The WiseMan software is preinstalled in all readers and can be released by buying a release key. This release key can be send to the reader via the ‘Options’ menu in the webpage. This software is copy-protected. The application software can only be executed from the reader on which it is installed. It is therefor not possible to move a piece of pre-installed application software from one reader to a second reader and then execute it on the second reader.

For further information about the WiseMan application software please contact Pepperl+Fuchs.

4.8 Interfaces

This section describes the standard interfaces available with the reader. Interfaces include communication interfaces, inputs and outputs, indicators and so forth. Each interface is briefly described.

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4.8.1 Service Interfaces

The controller board has an RS232 serial interface that serves as a service interface. As the interface name suggests, the service interface is used for service and maintenance. Logging on to the Linux system and having full access to the reader is possible through the service interface.

The service interface communication settings as shown in the table below, are static in order to facilitate customer support.

Setting	Static Value
Baud rate	115200 Baud
Data bits	8
Parity	None
Stop bits	1
Flow control	None

Table 4.2: Service interface communication settings

Note!

Do not use the service interface as an application port for standard communication. Doing so will compromise system security.

4.8.2 Serial Communication Interfaces

The reader has both a RS485 and a RS232 serial communication interface. Both interfaces can be individually configured regarding Baud rate, data bits, stop bits, parity bits, and so forth. See the corresponding product data sheet for more information about the supported settings. These interfaces are used by Reader application software like P+F_MONITOR to interact with other devices or with a host computer.

RS232 Serial Interface

The reader has a RS232 serial interface, which is a single-ended full-duplex interface. The RS232 interface is supported by drivers statically built into the Linux kernel.

RS485 Serial Interface

RS485 supports multi-drop serial networks. The communication can be in either full duplex of half duplex, that is 4-wire or 2-wire communication. The RS485 interface is more robust and less sensitive to transmission errors compared to a common RS232 interface. The RS485 interface is supported by drivers statically built into the Linux kernel.

4.8.3 Ethernet

The reader has a 10/100 Mbps fast Ethernet interface. The network interface supports auto-negotiation for automatic media speed and protocol selection as well as automatic MDI/MDI-X crossover. Indicators on the Ethernet connector show link activity and link speed. By default a reader has several services that use the Ethernet interface, such as HTTP, SSH and TAGP. Custom reader application software can apply standard Linux functions to use the network interface.

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4.8.4 USB Host

The controller board has two USB host interfaces that comply with the USB 2.0 full speed specification. The USB host interfaces can be used as interfaces for expanding the functionality within customer specific application software.

4.8.5 Micro SD memory Card

The controller board has a **s**ecure **d**igital (SD) memory card interface, which supports the physical form factor of micro SD, also known as TransFlash. The interface can be used to add more flash memory to the reader

4.8.6 Inputs and Outputs

The reader has several inputs and outputs, which can be used to incorporate the reader in a system.

Intergace	Description
Inputs	The reader has three optocoupler inputs. The inputs can be set to generate a software event on change. Each input signal is filtered such that glitches shorter than 15 milliseconds are removed.
Outputs	The reader has two open collector outputs that can be set high or low. The three Wiegand signals are also possible to control with software and use as outputs.
Relay output	The reader has one relay output for heavy duty loads, which can be set open or close.
Tampering switches	The reader has two mechanical tampering switches that break if the cover of the reader is opened. The first tamper switch is connected internally to the controller board and creates a software event when opened and closed. The second tamper switch has an interface which can be connected to an external alarm loop.

Table 4.3: Inputs and outputs

4.8.7 Indicators

The reader has visual indicators that can show red or green, or both, which is referred to as yellow. The indicators can also be turned off. The reader also has a buzzer for audible indication.

4.9 Features

This section describes some features found in system MT readers.

4.9.1 Web Server

The built-in web server presents a web interface to the reader. A standard web browser is used to log on to the reader via Internet or a local network. Status information can be received and configuration settings can be altered when logged on through a web browser. For information about logging on to the reader using a standard web browser, see section 6.2. The web server is a HTTP daemon, which is a very small web server adequate for low-traffic hosts.

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4.9.2 Frequency Hopping

The frequency hopping has a pseudorandom behaviour and is suitable for installations where frequency channel planning is not required or desired. Readers using frequency hopping are unaffected by other readers and unlikely interfered by other surrounding equipment. Subbands in which the frequency hopping takes place can be defined by software settings. At least 20 readers can operate in close proximity of each other when all are set to frequency hopping.

Continuous Wave (CW)	Transmitted frequency set to a fixed radio channel selected by user
CW-mode: Radiation frequency	2435 - 2465 MHz
CW-mode: Number of RF channels	93
CW-mode: Channel separation	300 kHz
Frequency Hopping Spread Spectrum (FHSS)	Frequency hopping function which can be set to operate over the complete radio 2400 - 2483.5 MHz band or over selected parts of the band. This will increase the performance and robustness due to the lowered risk of radio interferences.
FHSS-mode:	2400 - 2483.5 MHz
FHSS-mode: Number of RF channels	400
FHSS-mode: Channel separation	200 kHz

Table 4.4: Available channels and bandwidth - CW and FHSS mode

4.9.3 Realtime Clock

The reader has a battery-backed realtime clock that can present a time stamp with century, year, month, day, day of week, hour, minute, and second. Using the Linux system time, the resolution is 1/1000 of a second. The reader automatically handles daylight saving time if the correct time zone has been configured. The realtime clock's battery is charged as long as the reader unit is powered. The clock will run on battery if the power supply fails.

4.9.4 Watchdog Timer

The Linux kernel implements a watchdog timer that triggers a reader reset if the system/application software malfunctions. The intention is to bring the reader back from a hung state into normal operation.

4.9.5 Writing ID-tags

When writing ID-tags, the reader occupies a broader spectrum of the frequency band compared to when reading ID-tags. Only one ID-tag at a time is allowed in the reading lobe while writing. Frequency hopping must be disabled.

Configure the reader that writes ID-tags so that it is separated by at least two frequency channels from other readers in close proximity.

The ID-tag to be written on must be still and positioned with the front side directed towards the reader.

4.9.6 Spectrum Scan

The reader implements a spectrum scan tool that can be accessed through the web interface and works like a simple spectrum analyzer. This tool can be used to find interferers when selecting the best carrier frequency for a reader. See section 6.2.3.2 for more information.

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4.10 Environmental Considerations

The system MT technology is a reliable solution for identification systems because it is unaffected by the normal electromagnetic background noise found in industries and elsewhere.

Electromagnetic interference

Industrial noise is typically present in the kHz and low MHz frequency band. The system MT is using the 2.45 GHz frequency, so typical industrial noise will not affect the communication.

Electromagnetic interference in cables

By using specified cables, proper shielding and grounding as well as selecting a suitable communication interface, optimum communication reliability is ensured. For more information about cable specification see chapter 5.3.2

Lightning

In order to protect the reader from possible effects of lightning, additional surge protection on the inputs and outputs may be needed.

Temperature

For most applications, normal convection cooling is sufficient for the reader. If heat is generated close to the reader, the use of forced cooling or heat shielding should be considered.

Safety

To comply with Council Recommendation 1999/519/EC, it is recommended that the reader is installed so that a separation distance of at least 20 cm (8 in) from all persons is provided.

4.11 Environmental Specification

Climate

Parameter	Value	Reference
Cold	-30°C or -4°F	IEC 68-2-1 Ad
Heat	+60°C or 140°F	IEC 68-2-2 Bd
Sealing	IP65	IEC 60529

Mechanical

Parameter	Value	Reference
Shock	30 G, 6 ms, 10 x 3 dir	IEC 68-2-27 Ea
Bump	25 G, 6 ms, 1000 x 3 dir	IEC 68-2-29 Eb
Random vibration		IEC 60068-2-64

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Electrical

Parameter	Reference
Immunity	Acc. to CE: EN 301489-3
Emission	Acc. to CE: EN 300440-2 FCC part 15 subpart B and C Class A digital equipment
Safety	EN/IEC 60950-1
Electromagnetic fields	EN 50364 and EN 50357

The reader also conforms to the RoHS Directive 2002/95/EC

Note!

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial, industrial or business environment. If the equipment is not installed and used in accordance with the installation instructions below, it may cause interference to radio communications. In this case the user will be required to correct the interference at his own expense.

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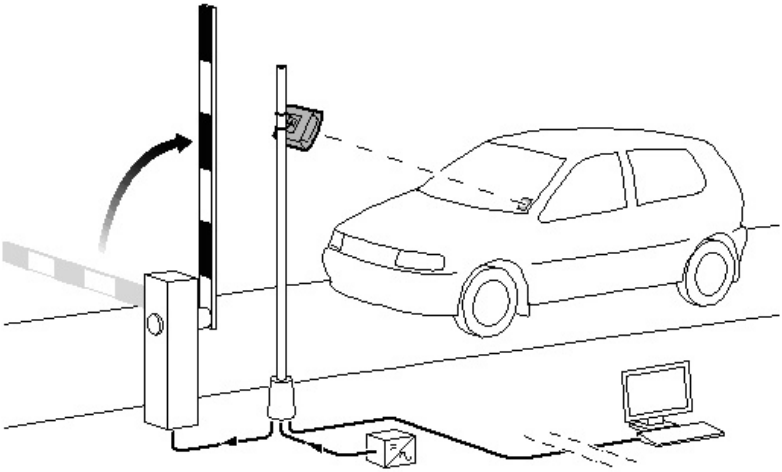
5 Installation

This section describes the procedure of installing the reader. This includes mounting the reader, installing the necessary cables, and performing an installation test. Read through this entire section before performing the installation.

The two main elements of a Pepperl+Fuchs identification system are the reader and the ID-tag. Peripheral elements are for example a host computer and other external devices, such as traffic lights and barriers.



The figure above shows the overview of a Pepperl+Fuchs identification system with a pole-mounted reader, an ID-tag mounted on the inside of a car windscreen, a host computer, a power supply, and a barrier.

The Pepperl+Fuchs system employs circular polarisation and can therefore be used when metal surfaces are in the vicinity of the antenna and the ID-tag, especially if the ID-tag is moving. In order to find the best arrangement, adjustment of the reader, ID-tag positions and distance may be necessary.

5.1 Storage and transport

For storage and transport purposes, package the unit using shockproof packaging material and protect it against moisture. The best method of protection is to package the unit using the original packaging. Furthermore, ensure that the ambient conditions are within allowable range.

5.2 Unpacking

Check the product for damage while unpacking. In the event of damage to the product, inform the post office or parcel service and notify the supplier.

Check the package contents with your purchase order and the shipping documents for:

- Delivery quantity
- Device type and version in accordance with the type plate
- Accessories
- Manual/manuals

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Retain the original packaging in case you have to store or ship the device again at a later date.

Should you have any questions, please contact Pepperl+Fuchs.

5.3 Preconditions

The locations of readers and ID-tags have been specified during the project planning phase, based on considerations of communication distances and movement speeds.

The cable paths and cable types have been determined during the project planning phase.

The power supply must comply with all relevant safety regulations.

The equipment must be disconnected from all voltage sources before any installation or service work is carried out. Capacitors inside the equipment can hold their charge even if the equipment has been disconnected from all voltage sources.

Caution!
Damage

Damage may be the result if the equipment is switched on, when parts are removed from the controller board, or if a PCB is removed within one minute after switching off the equipment.

5.3.1 Tools

The following tools are necessary for installation:

- Screwdriver, Torx T20
- Screwdriver, 2.5 mm flat-bladed
- Hammer
- Short metal tube, diameter 16 mm
- Side cutter
- Wire stripper
- Crimping tool for ferrules

5.3.2 Cables

Cables are not supplied with the system MT.

All cables must be shielded and suitable for the installation environment, for instance indoor or outdoor environment. Use flexible cables with stranded wire.

The terminal blocks used are Phoenix, type PT 1.5. These terminal blocks allow for a cable area of 0.2 to 1.5 mm² (AWG 26-14). Stranded wires must be fitted with a ferrule before being inserted in the terminal blocks.

The cable for the RS485 interface must be a twisted pair cable and conform to the EIA RS485 standard. A category 5 (CAT 5) cable is required for the Ethernet connection.

5.4 Mounting the Reader

Mount the reader in a horizontal position. In exceptional cases, the reader can be mounted in a vertical position.

Mount the reader on a bracket and direct the front side of the reader so that the reading lobe covers the positions of the ID-tags. The reader identifies ID-tags within the reading lobe that expands in front of the reader.

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For optimal performance, tilt and rotate the reader into a position so that the front side of the reader is parallel with the front surface of the ID-tag to be read. Align the reader so that the actual reading range is 60–70% of the specified maximum reading range.

The system MT reader is prepared for mounting directly in a bracket on the back side of the reader. The mounting holes enable the use of VESA 75 standard mounting brackets. There are several M4 holes which can be used to fasten the reader onto the mounting bracket. The mounting holes are sealed at the base, so the fixing screw must not extend more than 8 mm into the reader.

Note!

Do not drill any additional holes in the enclosure. This will affect the sealing specification.

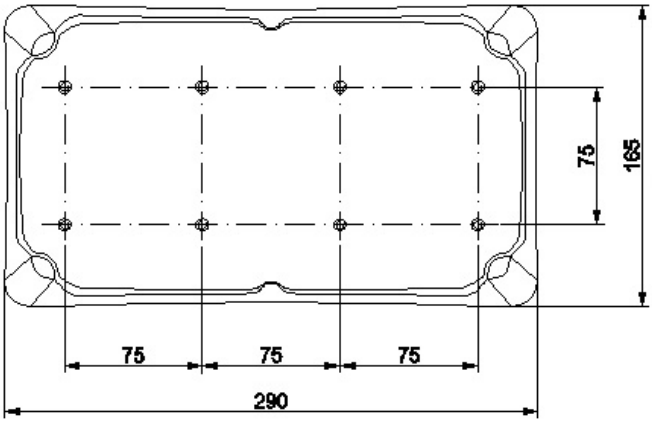
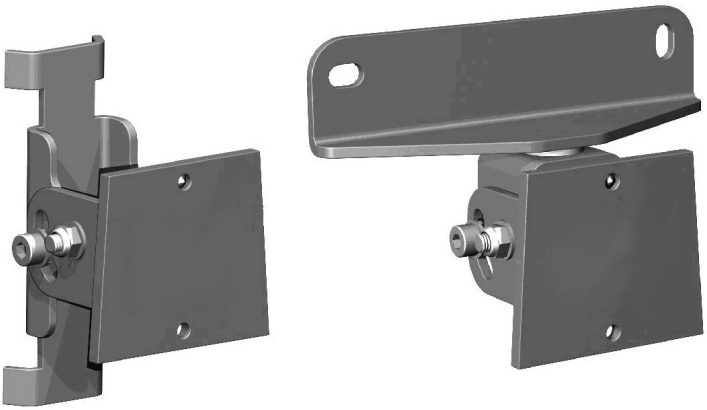


Figure 5.1: MTT6000-F120-B45 mounting hole layout on the back side of the reader (unit: [mm]) See datasheet for MTT3000-F180-B12-V45-MON mounting hole layout!.

For installation of the reader on a pole or a wall, Pepperl+Fuchs provides an universal mounting kit MTA-MH09.



Caution!
Damage

Never exceed the environmental and electrical limits as specified in see chapter 9.1. Exceeding the limits can result in permanent damage to the reader.

5.5 Cable Connections

The reader is provided with knock-outs for incoming cables on both the horizontal and vertical edges. First and foremost use the cable entries on the horizontal edge of the reader, even if the reader is mounted in a vertical position.

Note!

The reader is certified for an installation of maximum four separate incoming cables. Do not exceed this maximum number.

Cable connections

Warning!
Damage

Keep the reader closed when knocking out the cable entries to prevent damaging the enclosure. Be careful that the tube does not contact any components inside the reader.

1. Use a short 16 mm-diameter tube to remove the desired knock-outs. Tap the tube sharply using a hammer as illustrated below.

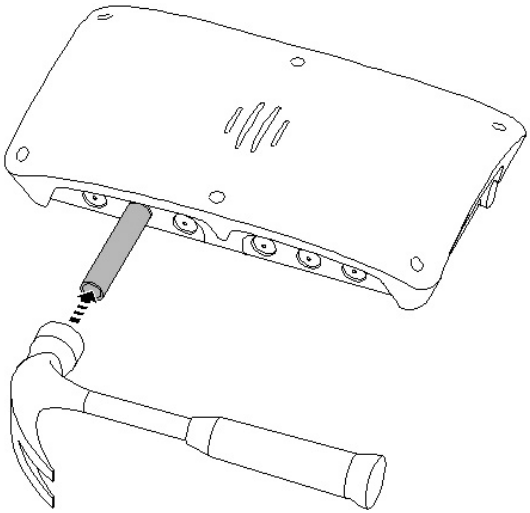


Figure 5.2: Knocking out the cable entries

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2. Open the reader using a torx screwdriver.
3. Insert metal cable glands into the holes.
4. Cut the power cable to a suitable length and pull it through the cable gland as illustrated below.

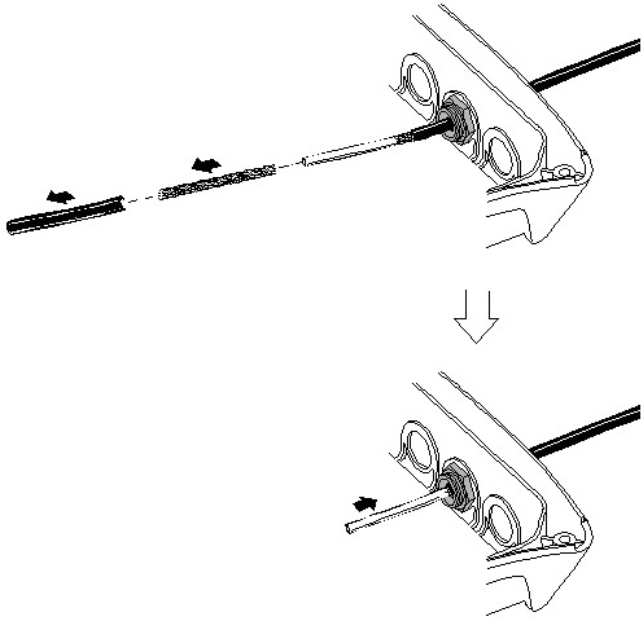

Figure 5.3: Grounding the cable in the cable gland

5. Connect the shield of the power cable to earth at the power supply end. The shield functions as earth connection for the reader.
6. Measure enough length of the cable to reach to the terminal block.
7. Strip the outer insulation and pull back the cable until the cable shield makes contact with the earthing fingers inside the gland.
8. Tighten the cable gland around the cable.
9. Cut away excessive length of the cable shield, strip the ends of the conductors, and crimp a ferrule onto the stripped end of each conductor.
10. Connect the power cable to group J31 (see chapter 5.5.4).
11. Make sure that the power source is turned off and connect the other end of the power cable to the power source.
12. Connect the remaining cables in the same manner. For connection of the Ethernet cable, see chapter 5.5.11

Caution!
IP classification

Do not remove pressure balance membrane. This will compromise the IP classification.

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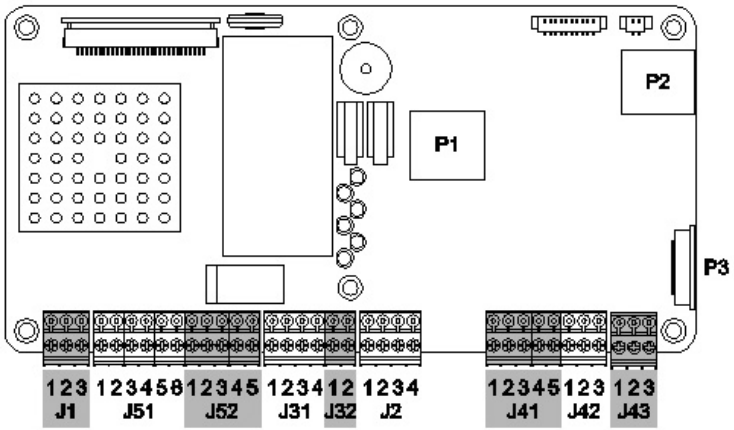

Figure 5.4: Controller board with external connections

Note!

It is possible to attach or remove the terminal block connectors inside the reader for more convenient connection of the cables.

The terminals are grouped as specified in the following sections.

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5.5.1 Interface isolation and protection

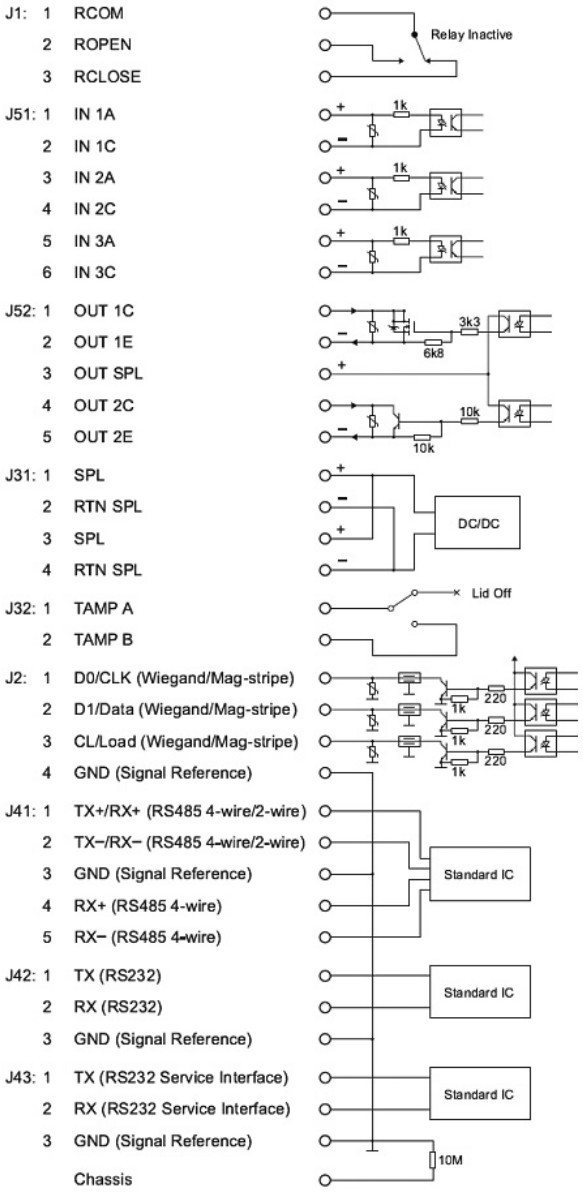

Figure 5.5: Pinning and schematic design of the readers interfaces

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The hardware design is protected against radiated or wired disturbances by extensive use of filters, transformers and shielding.

The power input is galvanically separated from the main electronic part of the reader by use of an onboard DC-DC converter. The interface block with Ethernet, serial interfaces and I/O signals is also galvanically isolated from the rest of the reader. This makes sure that no ground current will occur between shielding, power lines or other interfaces.

The common GND connection in J2 and J41-J43 is a floating reference ground for the interface block signals. This makes it possible to operate the interface with the voltage potential set from the other party. The reference ground is internally connected to the chassis via a discharge resistor to avoid static voltage potential. It has no other reference to connections outside the interface block.

The USB port GND is connected to the chassis. The Wiegand/Magstripe interface, the isolated inputs, and isolated outputs have a varistor protection that will short-circuit signals over the rated maximum of 30 V.

5.5.2 Relay Output, Group J1

The controller board has one relay output for heavy duty loads.

Pin	Signal	Description
1	RCOM	Common terminal or relay
2	ROPEN	Connected to RCOM when relay is open
3	RCLOSE	Connected to RCOM when relay is closed

Table 5.1: Relay output, group J1

5.5.3 Wiegand/Magstripe, Group J2

The controller board has an access control interface that supports both Wiegand and Magstripe protocols, which could be accessed via a customer tailored application program. Please ask Pepperl+Fuchs for further information.

Pin	Signal	Description
1	D0	Wiegand 0 (zero) signal
2	D1	Wiegand 1 signal
3	CL	Card load signal
4	GND	Ground

Table 5.2: Wiegand, group J2

Pin	Signal	Description
1	CLK	Magstripe clock signal
2	DATA	Magstripe data signal
3	LOAD	Card load signal
4	GND	Ground

Table 5.3: Magstripe, group J2

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5.5.4 Power Supply, Group J31

Pin 1 is internally connected to pin 3 and pin 2 is internally connected to pin 4. The purpose is to make it possible to feed power to any peripheral equipment. Use pins 1 and 2 for power supply connection.

Pin	Signal	Description
1	SPL	Positive DC supply input
2	RTN SPL	Negative DC supply input
3	SPL	Positive DC supply input, internally connected to pin 1
4	RTN SPL	Negative DC supply input, internally connected to pin 2

Table 5.4: Power supply, group J31

5.5.5 External Tamper Switch, Group J32

To protect the reader from tampering, there are two mechanical tampering switches which break if the cover is opened. One tamper switch is connected internally to the controller board and will generate a software alarm when broken. The other is an external tamper switch interface which can be connected to an external alarm loop.

Pin	Signal	Description
1	TAMP A	When the tamper switch is open, TAMP A and TAMP B are connected
2	TAMP B	

Table 5.5: External tamper switch, group J32

5.5.6 RS485 Serial Communication Interface, Group J41

The controller board has one RS485 serial interface for both 2-wire and 4-wire communication. RS485 supports multi-drop serial networks. The communication can be in both full duplex (4-wire) and half duplex (2-wire).

Note!

If the installation requires long cables or high data speeds it may be necessary to use termination

Pin	Signal	Description
1	TX+	Transmitted data, from reader to host
2	TX?	
3	GND	Ground
4	RX+	Received data, to reader from host
5	RX?	

Table 5.6: Full duplex (4-wire) RS485 serial communication interface, group J41

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Pin	Signal	Description
1	TX/RX+	Transmitted and received data, to and from host
2	TX/RX?	
3	GND	Ground
4	NC	Not used
5	NC	

Table 5.7: Half duplex (2-wire) RS485 serial communication interface, group J41

5.5.7 RS232 Serial Communication Interface, Group J42

The controller board has one RS232 serial interface.

Pin	Signal	Description
1	TX	Transmitted data, from reader to host
2	RX	Received data, to reader from host
3	GND	Ground

Table 5.8: RS232 serial communication interface, group J42

5.5.8 Service Interface, Group J43

The service interface is used for maintenance and configuration of the reader. Do not use the service interface as a regular system interface.

Pin	Signal	Description
1	TX	Transmitted data, from reader to host
2	RX	Received data, to reader from host
3	GND	Ground

Table 5.9: Service interface, group J43

5.5.9 Isolated Inputs, Group J51

The reader has three isolated optocoupler inputs which are protected from noisy environments.

Pin	Signal	Description
1	IN 1A	Input signal 1
2	IN 1C	Input reference 1
3	IN 2A	Input signal 2
4	IN 2C	Input reference 2
5	IN 3A	Input signal 3
6	IN 3C	Input reference 3

Table 5.10: Isolated inputs, group J51

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5.5.10 Isolated Outputs, Group J52

The reader has two open collector outputs.

Pin	Signal	Description
1	OUT 1C	Output 1 collector
2	OUT 1E	Output 1 emitter
3	OUT SPL	External supply voltage for the outputs
4	OUT 2C	Output 2 collector
5	OUT 2E	Output 2 emitter

Table 5.11: Isolated outputs, group J52

5.5.11 Ethernet, Connector P1

An RJ-45 connector labelled P1 with two internal indicators is provided for Ethernet connection. The clip for detaching the cable faces upwards from the controller board surface to allow midboard mounting. The Ethernet connector has eight pins. The wire scheme is based on the T568A standard. The pins are wired straight through the cable. I.e. pins 1 through 8 on one end are connected to pins 1 through 8 on the other end.

Note!

The RJ-45 connector will not pass through the cable gland. Pass the Ethernet cable through the cable gland before crimping the connector on the cable.

5.5.12 USB Host, Connector P2

USB devices are connected using a standard USB type A connector.

5.5.13 Micro SD Memory Card Interface, Socket P3

A standard micro SD memory card socket is used. The card socket is placed on the underside of the controller board.

5.6 Installation Test

After having completed the installation as described in the previous sections, carry out an installation inspection and verification. If an error occurs, the guidelines in sthe chapter ‘Trouble Shooting’ may be valuable. ()

5.6.1 Inspection

Ensure that there are no metal objects between or close to the reader and the ID-tag in the positions where communication is to take place.

Ensure that the reader and the ID-tag are aligned properly. Avoid communication at maximum specified distance and misalignment.

Ensure that the reader is not placed in a location where it is exposed to excessive heat or electromagnetic interference.

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5.6.2 Verification

The installation verification is as follows:

1. Keep the lid of the reader open.
2. Switch on power to the reader.
3. Observe the behaviour of the system status indicators on the controller board. The yellow, red, and green system status indicators will be on continuously.
4. The green system status indicator will start flashing after about 30 seconds, indicating that the software is running.
5. The buzzer will sound a short beep and the red system status indicator will start flashing when the hardware is initiated and running.
6. If the reader is connected to an Ethernet network, the green link state indicator on the Ethernet connector will be on to indicate a 100 Mbps connection or off to indicate a 10 Mbps connection. The yellow activity indicator on the Ethernet connector will be flashing to indicate present network communication.

If the hardware fails to initiate, the Reader will make two more attempts to initiate it. Each attempt is indicated by a short beep. If the hardware does not initiate after three attempts, contact Pepperl+Fuchs.

Close the reader, fit the lid to the base enclosure, and fasten the screws on the lid. Tighten the screws to a torque of 1 Nm in order to seal the enclosure without destroying the gasket. Clean up the site and dispose of any debris from the work.

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6 Configuration and Commissioning

The reader has a web interface and a terminal interface for configuration and maintenance. The web interface can be accessed over the network from a standard web browser. The terminal interface can be accessed over the serial service interface or over the network using **s**ecure **sh**ell (SSH).

Both interfaces are password protected. The username is admin and the default password is qwerty. It is recommended to change the password to prevent unauthorized access.

6.1 Connecting the Reader to a PC

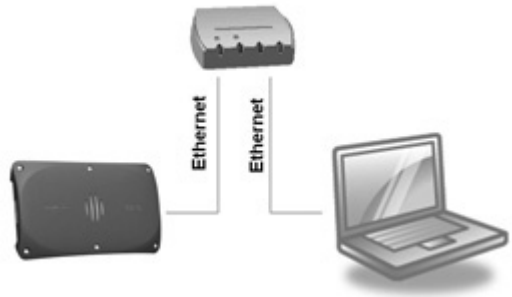
To configure the reader it is necessary to connect it to a PC. This can be done in several ways as shown below:

Terminal interface only

Serial RS 232 connection
The terminal interface can be accessed through the serial service interface. For this type of connection see chapter 6.1.1.

Terminal & web interface

Direct Ethernet connection
The terminal interface and the web interface can be accessed through a direct Ethernet connection. For this type of connection see chapter 6.1.2.



Terminal & web interface

Network connection
The terminal interface and the web interface can be accessed when the reader and the PC are both connected to a network with a DHCP server. For this type of connection see chapter 6.1.3.

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6.1.1 Serial RS 232 Connection

A terminal emulation program is required to connect to the serial service interface. A suitable program is e.g. “HyperTerminal” that is included in Windows XP. Many modern PCs don't have built in serial ports. A serial port can be added by using a USB to serial adapter. The following serial settings should be used in the terminal emulation program:

Baud rate:	115200
Data bits:	8
Stop bits:	1
Parity:	None
Flow control:	None

A cable for connecting the service interface to a 9-pin PC COM port should be created as specified in the following table.

9-pin D-sub Connector (female on cable)		Reader Connector (J43)	
Pin	**Signal**	**Pin**	**Signal**
2	RXD	1	TX
3	TXD	2	RX
5	GND	3	GND

Table 6.1: Cable specification: PC COM port <-> reader service interface

Example

After a power reset the switch on message appears first. Then you see the login procedure. With the command ‘ifconfig’ you can check the IP address. With the command in the last line the IP address is set to another value. This address is valid until the power is switched off again. During that time You can connect yourself to the reader via the webpage and configure the entire unit.

```
*******************************************************************************
**** Pepperl+Fuchs MTT6000-F120-B12-V45 - System Software v1.6.2 ****
*******************************************************************************
tagload: module license 'Proprietary' taints kernel.
tagload v1.6.0 (Apr 15 2009 09:40:56) loaded
tagmod v1.6.1 (Aug 11 2009 11:03:57) loaded
at91_mci at91_mci: 4 wire bus mode not supported - using 1 wire
eth0: Setting MAC address to 00:18:58:10:1b:d2
eth0: Link now 100-FullDuplex

tagd v1.6.1 (Aug 14 2009 11:40:51) started on port 9999

Welcome to Linux PF-JW-Demokit login: root
Password: qwerty

login[880]: root login on `ttyS0'

BusyBox v1.2.1 (2008.04.29-07:59+0000) Built-in shell (ash)
Enter 'help' for a list of built-in commands.

PF-JW-Demokit:~$ ifconfig
eth0 Link encap:Ethernet HWaddr 00:18:58:10:1B:D2
inet addr:172.24.55.162 Bcast:172.24.55.191 Mask:255.255.255.192

PF-JW-Demokit:~$ ifconfig eth0 192.168.0.2 netmask 255.255.255.0
PF-JW-Demokit:~$
```

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6.1.2 Direct Ethernet Connection

The reader can be directly connected to a PC with an Ethernet cable. Automatic MDI/MDI-X crossover support makes it possible to use either a straight through cable or a crossover cable. When connected directly to a PC, the reader uses a fixed IP address which is set to 192.168.0.2 at delivery. The IP address of the PC should be set to an address that is in the same subnet. A suitable address is 192.168.0.1. In Windows XP, the IP address can be configured like this:

- Open the control panel
- Select “Network Connections”
- Select “Local Area Connection”
- Press the “Properties” button
- Select “Internet Protocol (TCP/IP)” in the list and press the “Properties” button
- Select “Use the following IP address”
- Enter 192.168.0.1 for the IP address
- Enter 255.255.255.0 for the subnet mask
- Close all windows by pressing “OK“ or “Close”

Tip

If you frequently switch between connecting your PC to a network with a DHCP server and connecting it directly to a reader there is a convenient feature in Windows XP that makes it possible to specify dual network configurations.

In the “Internet Protocol (TCP/IP) Properties” dialog, leave the configuration under the “General” tab as is (usually “Obtain IP Address automatically”). Click on the “Alternate Configuration” tab and select “User configured”. Enter 192.168.0.1 for IP address and 255.255.255.0 for subnet mask. Close all windows by pressing “OK” or “Close”. When the PC is connected to a network with a DHCP server it will automatically obtain an IP address.

When the PC is directly connected to a reader it will use 192.168.0.1.

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Example

This connection is used e.g. by the P+F_MONITOR application software.

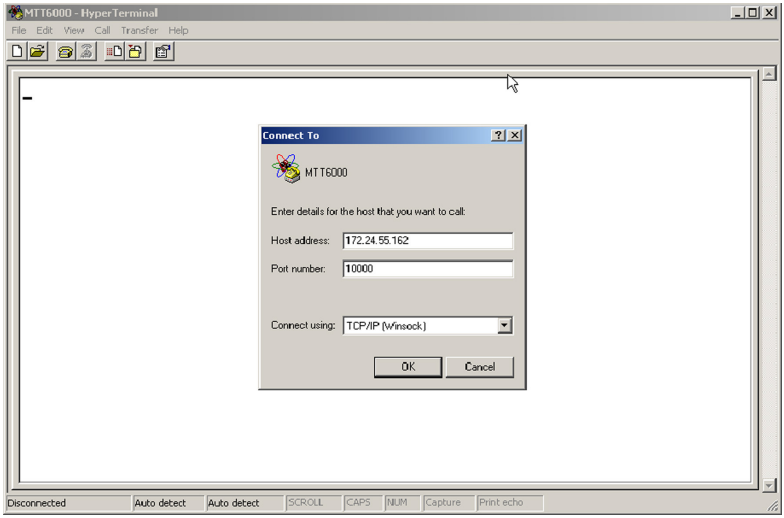

Figure 6.1: Connecting via Ethernet - Windows XP, using HyperTerminal

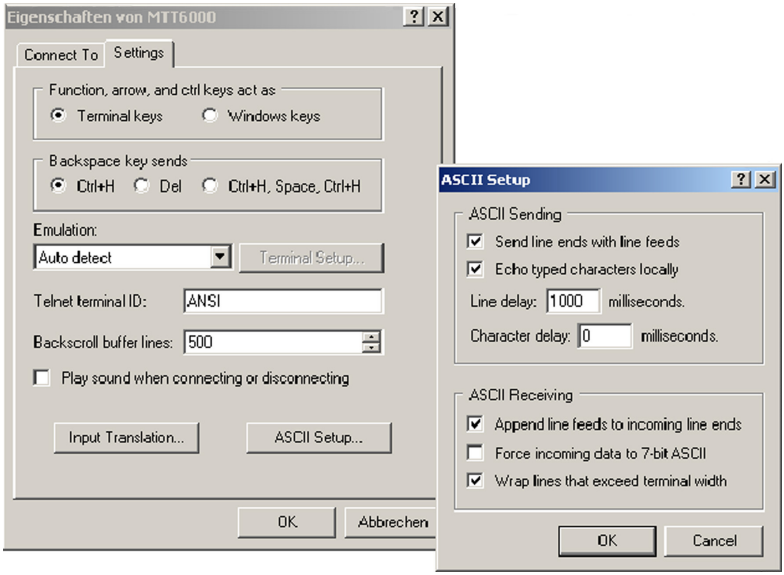

Figure 6.2: Connecting via Ethernet - Settings in Windows XP

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6.1.3 Network Connection

When the reader is connected to a network with a DHCP server it will automatically obtain an IP address. To connect to the reader's web interface, it is necessary to find the reader's IP address or use a service discovery tool. The reader implements service discovery with the mDNS/DNS-SD protocols (see <http://www.multicastdns.org> for more information).

One way to find the IP address is to use the serial terminal interface. The IP address can be found under "Information…/General Info".

A freely available mDNS/DNS-SD service discovery tool is called "Bonjour" and can be downloaded from the following page:

<http://www.apple.com/downloads/macosx/apple/windows/bonjourforwindows.html>

After installation, a bonjour button () will be available on the command bar in Internet Explorer (marked by an arrow). Click on the button to display all discovered web pages at the left edge of the Internet Explorer window. Readers will show up with their hostnames. The default hostname is Pepperl+Fuchs-xxxxxx where xxxxxx is the last (unique) part of the reader's Ethernet address. Double click on a reader in the list to open the reader's web interface. The host name can be changed under "Settings…/System…/Network" using the web interface or the terminal interface.

6.2 Web Interface

Connect to the web interface with a standard web browser. Enter the reader's IP address in the address field (default address: http://192.168.0.2)

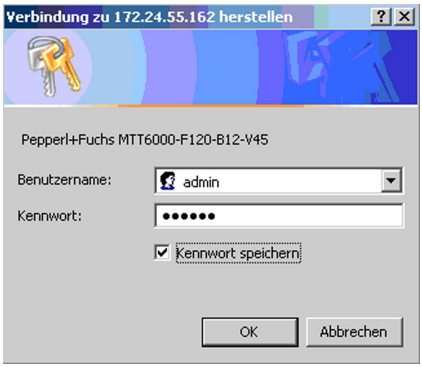

Figure 6.3: Web Interface Log in

Log in with user name admin and password qwerty to open the reader's start page. The following picture shows the start page with the menu expanded to show all menu items. The different items are described in the following sections.

Note!

If some of the described Java applications are not displayed on your web browser, you might need to update your Java Runtime Editor.

Figure 6.4: Web interface start page

6.2.1 Information

The menu "Information" provides the following reader status information.

General Information

The “General Info” page provides information about system time, system up time, software and hardware versions, memory usage and network configuration.

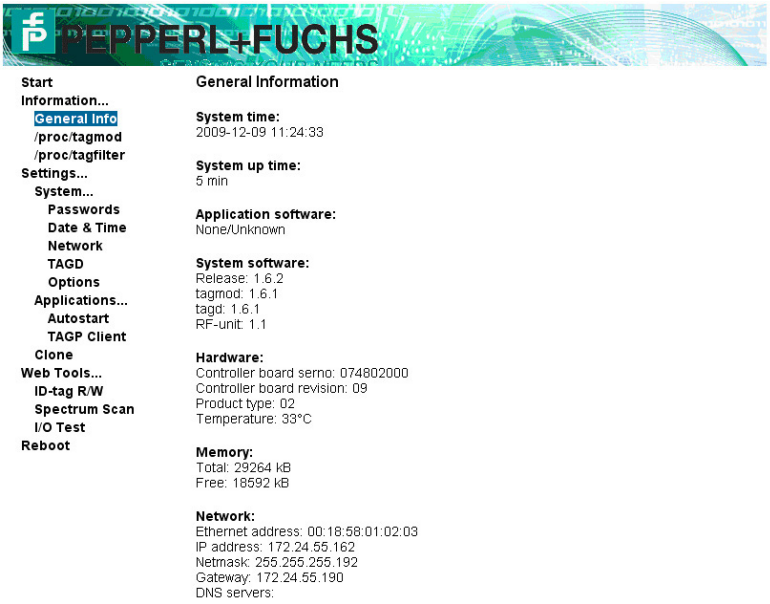

Figure 6.5: Information / General Info

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/proc/tagmod

This submenu provides detailed information about the reader. The information is relevant only to the Pepperl+Fuchs technical support.

/proc/tagfilter

This submenu provides detailed information about the Reader. The information is relevant only to the Pepperl+Fuchs technical support.

6.2.2 Settings

The menu "Settings" is used to configure system and application settings.

Settings…/System…/Passwords

The submenu "Passwords" is used to change the passwords for users admin and root. The admin user has access to the web and terminal interfaces. The root user has access to the Reader's operating system. The default passwords for both users are qwerty.

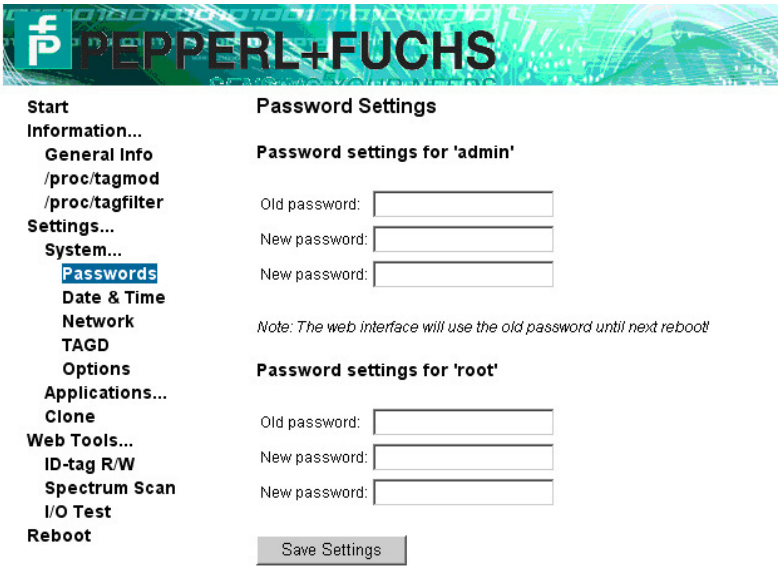

Figure 6.6: Settings…/System…/Passwords

Settings…/System…/Date & Time

The submenu "Date & Time" is used to set the time zone, date, and time of the reader's battery-backed realtime clock. The reader automatically handles daylight saving time if the correct time zone has been configured. The default time zone, UTC, does not use daylight saving time.

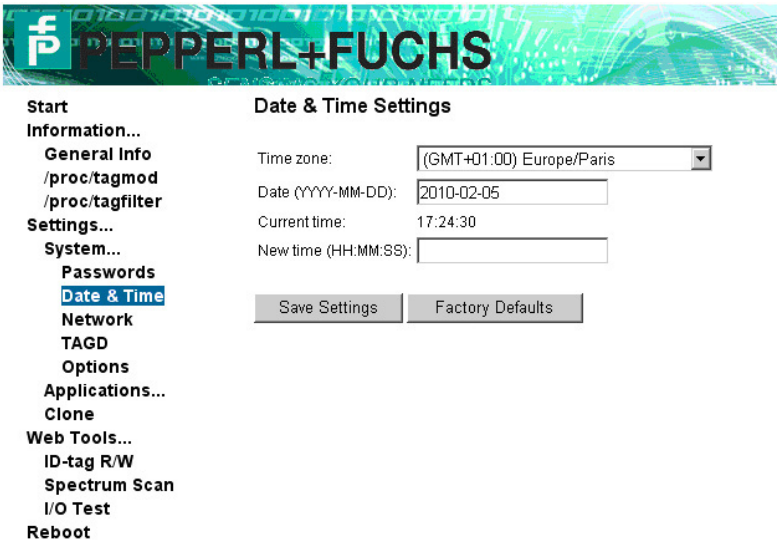

Figure 6.7: Settings…/System…/Date & Time

Settings…/System…/Network

The submenu "Network" is used to configure the reader's network settings. When the settings have been saved, the reader has to be rebooted to activate them.

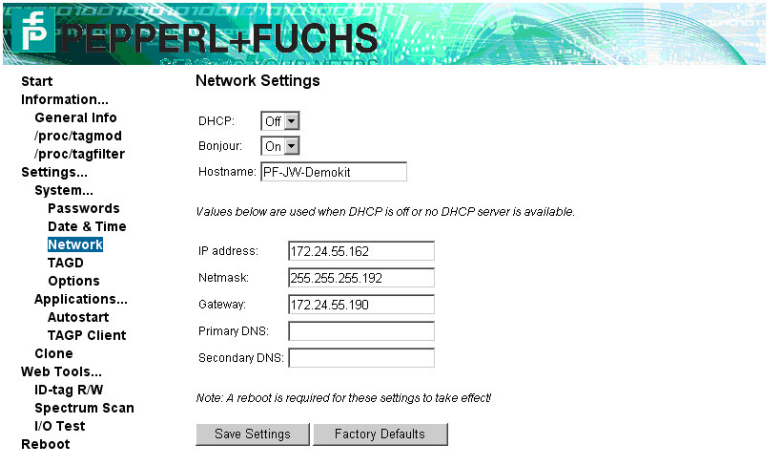

Figure 6.8: Settings…/System…/Network

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The settings are described below:

Setting	Description
DHCP	= **D**ynamic **H**ost **C**onfiguration **P**rotocol. If DHCP is on (default), the reader will try to obtain network settings from a DHCP server. If DHCP is off or no DHCP server is found, the reader uses the default values specified at the bottom of the page.
Bonjour	Bonjour is a service discovery system based on the mDNS/DNS-SD protocols. If Bonjour is on (default), the reader will advertise its existence on the local network and can be found with service discovery tools like Bonjour as described in the previous section (see chapter 6.1.3).
Hostname	The unique name by which a reader is known on a network. This name is used to identify the reader with the Bonjour service discovery tool. The default hostname is PepperlFuchs-xxxxxx where xxxxxx is the last and unique part of the reader's Ethernet address.
IP address	Every network interface on a TCP/IP network must have a unique IP address. If the device is part of the Internet, its IP address must be unique within the entire Internet. If a device's TCP/IP communications are limited to a local network, its IP address only needs to be unique locally.
Netmask	To communicate properly, each device (reader or host) on a network must use the same subnet mask. The subnet mask is set to "255.255.255.0" by default.
Gateway	If the reader communicates with devices that are not on its local network, a default gateway address is needed.
DNS	= **D**omain **N**ame **S**erver To resolve hostnames into IP addresses, each reader needs to know the addresses of one or several domain name servers.

Table 6.2: Network settings

Settings…/System…/TAGD

The submenu "TAGD" is used to configure default settings for the reader.

Note!

Application software may override these settings!

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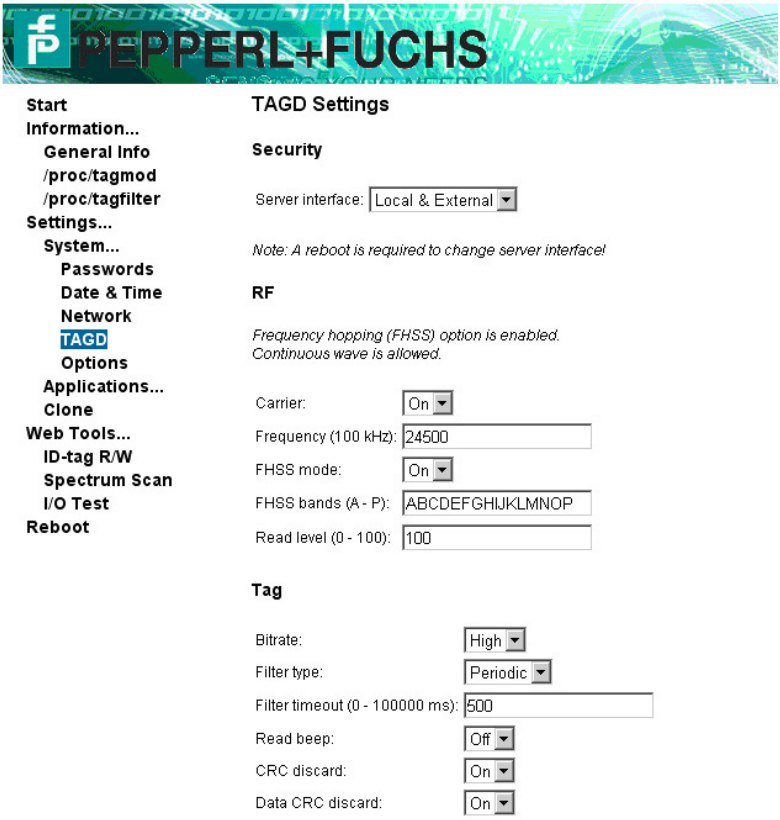

Figure 6.9: Settings…/System…/TAGD

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The settings are described below:

Settings	Value	Description
Security		
Server Interface	local & external	It is possible to connect to TAGD from reader-hosted applications as well as from the network
	local	It is only possible to connect to TAGD from reader-hosted applications, not from the network. **Note:** It is possible to connect to TAGD through an encrypted SSH tunnel!
RF		
Carrier	On	RF carrier is on
	Off	RF carrier is off
Frequency	24363-24639	RF carrier frequency
FHSS mode	On	Frequency hopping is on
	Off	Frequency hopping is off
FHSS bands	A..P	Specifies which frequencies to use for frequency hopping. See 6.6 for more information
Read level	0-100	Specifies the reading range in 100 steps where 100 is the maximum range
Tag		
Bitrate	High	High-speed tags are read
	Low	Low-speed tags are read
Filter type	Off	All tags are reported to applications
	Periodic	Tags are reported periodically
	Once	Tags are reported once
	Report	N/A
Read beep	On	The reader beeps when a tag is read
	Off	The reader does not beep when a tag is read
CRC discard	On	Tags with bad CRC are discarded
	Off	Tags with bad CRC are not discarded
Data CRC discard	On	MTM-Tags with bad userdata CRC are discarded
	Off	MTM-Tags with bad userdata CRC are not discarded

Table 6.3: TAGD settings

Settings…/System…/Options

The submenu "Options" is used to unlock certain reader options like the preinstalled application software WiseMan with an encrypted key. Paste the key into the key field, save the settings and reboot the reader to activate the key. Please contact Pepperl+Fuchs about information of available reader options.

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Settings…/Applications…/Autostart

The submenu "Autostart" is used to select which application software to run on readers that are allowed to run multiple applications. All enabled application are available in the Autostart list box. In addition the following choices are available:

- Default Application – For backwards compatibility. Starts the reader's default application as in previous system software versions (< 1.6.0).
- Command Line – For advanced users. Executes an operating system command line as specified in the "Command line" field.
- P+F Monitor – This application software offers multiple ways of optimizing the communication to specific needs of customer applications. This option is activated on new readers delivered by Pepperl+Fuchs.

Figure 6.10: Settings…/Applications…/Autostart

Settings…/Clone

The submenu "Clone" is used to save reader settings including the WiseMan database to a USB storage device. The settings can then be imported to another reader.

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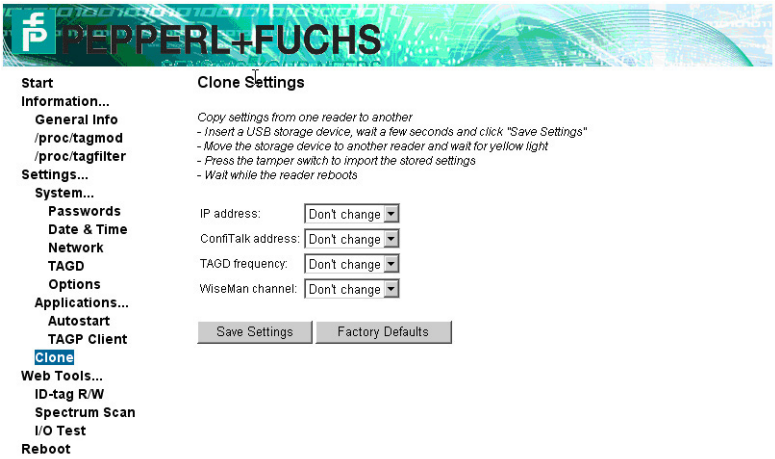

Figure 6.11: Settings…/Clone

To save settings:

- Connect a USB storage device to the reader
- Select suitable options
- Press “Save Settings”

Options are available for parameters such as IP address and ConfiTalk address. These addresses should usually be different on each reader. The following options are available:

Settings	Description
Don’t change	Don’t change this setting when importing, leave the setting as is on the importing reader
Increment	Increment this setting when importing, generate a unique value on the importing reader
Copy	Copy this setting when importing, set to same value as on original reader

Table 6.4: Clone settings

To import settings:

- Insert the USB storage device into a reader
- Wait for the visual indicator to turn yellow
- Press the tamper switch to import settings
- Wait for the visual indicator to turn green
- Wait while the reader reboots to activate the imported settings

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6.2.3 Web Tools

The menu "Web Tools" contains different utilities, which are available on the web interface.

Web Tools…/ID-tag Read/Write

The submenu "ID-tag R/W" can be used to read and write to ID-tags.

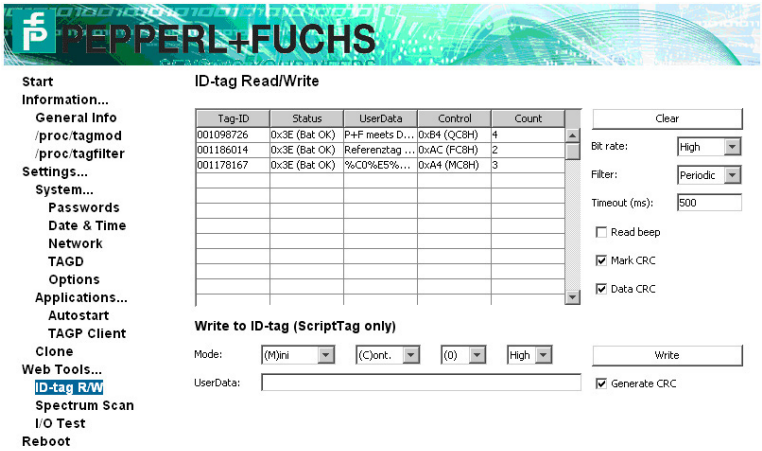

Figure 6.12: Web Tools…/ID-tag R/W

Read ID-tags are shown in a table, one ID-tag per line. The different columns show the ID-tag's ID, Status (battery OK or LOW), UserData, Control for MTM-Tags and the number of times the ID-tag has been read.

The button "Clear" clears the table and resets the count column

The field “Bit rate” determines if the reader should read ID-tags with high or low bit rate.

The fields “Filter” and “Timeout” select the tag filter type and period:

- **Off** - no filter is used
- **Periodic** - an ID-tag is reported periodically with a time period specified by the filter timeout
- **Once** - an ID-tag is reported once and must be out of the reading lobe for the specified filter timeout before it is reported again

The clickbox “Read beep” enables/disables read beep

The clickbox “Mark CRC” enables/disables checking of the ID-tag's mark CRC

The clickbox “Data CRC” enables/disables checking of the ID-tag's userdata CRC

To write to a MTM-Tag, select “Mode” and “UserData” and press the “Write” button. Click on an ID-tag in the list to copy its current mode and UserData to the “Mode” and “UserData” fields. UserData is written in TAGP format which is ASCII with possibility to write any character as %xx where xx is a hexadecimal value between 00 and FF.

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Web Tools…/Spectrum Scan

The submenu "Spectrum Scan" contains a spectrum analyzer, that shows the frequency spectrum as seen by the reader. This information can be used to find interferers when selecting a suitable frequency for the reader.

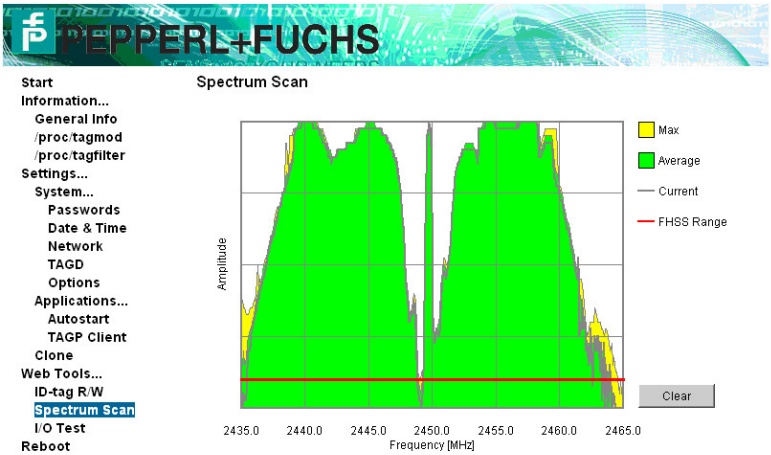

Figure 6.13: Web Tools…/Spectrum Scan

The gray line shows the current scan. The yellow area shows the peak value for each frequency. The green area shows the average value for each frequency. The red line shows the reader's own frequency as a vertical line or the use of FHSS as a horizontal line.

Web Tools…/I/O Test

The submenu "I/O Test" can be used to test reader inputs and outputs and verify that connections to external systems work as expected.

Figure 6.14: Web Tools…/I/O Test

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6.2.4 Reboot

The menu "Reboot" allows you to reboot the reader

6.3 Usefull Software Tools

The following table list software tools, that are useful when working with a reader.

Application	Description
TeraTerm	Free terminal emulator/SSH client for Windows <http://sourceforge.jp/projects/ttssh2>
HyperTerminal	Bundled with multiple versions of Microsoft Windows (not Windows Vista)

Table 6.5: Terminal emulator software

Windows text editors usually use carriage return (CR) plus line feed (LF) as end-of-line character. The reader's Linux operating system expects files to have a single line feed as end-of-line character. When editing reader files on a PC it is recommended to use an editor that can handle Linux line endings.

6.4 Configuration of the software 'P+F_MONITOR'

6.4.1 Configuration of the reader

The reader uses a setup string to configure itself for the correct mode of operation and parameter settings. This string is stored on the reader in a file. Typically the configuration of each reader is different. The microwave channel and the read range are the two most commonly configured parameters. Also each reader may have a unique name. The configuration can be modified in a number of ways including through serial/Ethernet ports, or setup tag. Here are examples of each. The default configuration on delivery is $SMDeskC98R4B1, which means operation in Standard Mode, Frequency Hopping, 100% Readrange, Baudrate Serial Interface = 9600.

Configuration

Note!

Use capital letters for all parameter data!

1. Connect to the reader, either to ports 1 or 2 serially or via Ethernet. Send the L command to the reader to read out the existing configuration. See „Reading the Configuration". The response will start with a status "0" and a 3-digit length and ends with <CR>. Use the C command to configure the readers. See „Writing the Configuration". The response will be immediate. The reader reboots automatically. The normal boot up string can be used to verify the configuration.
2. Once the reader is configured, the configuration can be written to a setup tag. See „Writing Setup Tags". If this tag is placed in front of the reader during the 30 s boot up time, the reader will be configured automatically. Special commands are used to write a tag with the current configuration of the reader. There is also a command to read the setup tag. See „Reading Setup Tags". Once the tag data has the setup tag format, it will not be reported as a data tag. Setup tags are very handy if you have to replace a reader. A separate setup tag should be used for each reader, because every reader typically has a unique configuration. The new reader is wired up and the setup tag is placed in front of the reader on boot up. Configuration of the reader is completed and the reader runs normally.

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Reading the Configuration

	Command	L<CR>
	Response	<Status><L3><ASCII_CAP_Data><CR>
Example:	Command	L<CR>
	Response	0028UUUUStim05C01R4B1LF5T23H26A0<CR>

Writing the Configuration

	Command	C<L3><Configuration string><CR>
	Response	<Status><CR>
Example:	Command	C028 UUUUStim05C01R4B1LF5T23H26A0<CR>
	Response	0<CR> The reader will reboot automatically

Writing Setup Tags(The MTT3000-F180-B12-V45-MON can't write!)

	Command	K<CR>
	Response	<Status><CR>
Example:	Command	K<CR>
	Response	0<CR> If a tag placed in front of the reader and write is successful

Reading Setup Tags

	Command	M<CR>
	Response	<Status><L3><Configuration string><CR>
Example:	Command	M<CR>
	Response	0028UUUUStim05C01R4B1LF5T23H26A0<CR>

6.4.2 Configuration string options

The configuration string holds all parameters to run the reader. Each mode of operation has a specific parameter set, that must be included in the string. All parameters required for that operating mode must be included in the string for the configuration to be valid. Otherwise an error code 4<CR> is returned. Capital letters must be used for all parameter data.

$$$$	These are the first 4 characters of the configuration string for standard, enhanced and track mode
UUUU	These are the first 4 characters of the configuration string for universal mode

Table 6.6: Configuration strings

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In the following table, the default configuration string for standard mode SMDeskC98R4B1 is explained in detail:

	Stan-dard	En-hanced	Track	Uni-versal	Options	Default
S(text, 5)	**X**	**X**	**X**	**X**	Station ID, any 5 character text	**SMDesk**
C(num, 2)	**X**	**X**	**X**	**X**	Frequency channel 5-97 01,02 - frequency hopping default sub-bands 03,04 - adaptive frequency hopping default sub-bands 98 - frequency hopping all bands 99 - adaptive frequency hopping all bands A1-P1 - specific bands, frequency hopping A2-P2 - specific bands, adaptive frequency hopping	**C98**
R(num,1)	**X**	**X**	**X**	**X**	1-4 and A-J, range 1 to 100%	**R4**
B(num,1)	**X**	**X**	**X**	**X**	B0-BE 4800 bps to 115,200 bps, 2-wire or 4-wire RS 485 Default – 9600 bps, 4-wire RS 485	**B1**
L(xn,2)		**X**	**X**	**X**	F1 to F5 = fixed length, exactly 1 up to 5 characters V1 to V5 = variable length max. 1 up to 5 characters 01 to 71 fixed length, exactly 1 up to 71 char F8 = :Mark only, FA = data :Mark Default: F5	-
T(hex,2)		**X**	**X**	**X**	The hex value of the termination character Default: #	-
H(hex,2)			**X**	**X**	The hex value of the prefix character Default: &	-
X(hex,2)			**X**		The hex value of the handshake character	-
M(num,1)			**X**		1 = one tag is scanned and reading stops 2 = two tags are read and reading stops … 0 = continuous reading	-
A(num,1)				**X**	0 = no heartbeat 1 = unsolicited heartbeat every 1 min 2 = unsolicited heartbeat every 1 min, handshake required	-

Table 6.7: Configuration string options

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Examples of configuration of different modes

Standard mode station “str05”, microwave channel 30, baud rate 9600, Range 2	$$$$Sstr05C30R2B1
Enhanced mode station “MMM06”, adaptive frequency hopping default bands, baud rate 9600, range 4, Fixed format length 10, terminator carriage return	$$$$SMMM06C03R4B1L10T0D
Track mode station “12345”, channel 10, baud rate 9600, range 1, Fixed length 5, no terminator, no prefix, no handshake, one tag read after LON issued	$$$$S12345C10R1B1LF5T00H00X00M1
Universal mode station “abcde”, channel 97, baud rate 9600, Fixed length 71. Terminator carriage return, no prefix, with heartbeat and no user acknowledge	UUUUSabcdeC97R4B1L71T0DH00A1

Detailed explanation of configuration options

S(text,5)	The letter “S” followed by exactly 5 characters is used as a station ID and is stored in memory.
C(number,2)	The letter “C” followed by exactly 2 digits defines the microwave channel used for communications. This is a powerful feature that allows many readers to work in close proximity to one another without interference.

Individual readers must be set to different frequencies, if they are being used in the same plant in close proximity to one another. It may be beneficial to set readers to a channel gap of 2 or more to minimize mutual interference. Certain frequencies may be used by other hardware in the plant and these frequency bands must be avoided, otherwise the read/write range may be very low. Alternatively frequency hopping or adaptive frequency hopping can be used. Frequency hopping will allow the reader to change its frequency automatically when reading. If there is interference and a read is unsuccessful, the next time the frequency changes the read may be successful. Adaptive frequency hopping will allow the reader to listen at a specific frequency before using it. If that frequency is taken, the reader will try another fequency. Readers cannot write while frequency hopping. The reader switches off frequency hopping and the last channel recognised will be used for the write functionality. If one unit is always used for writing then a fixed frequency channel should be used. The fixed channel settings 5-97 have a frequency separation of 300 kHz. The individual channels used, when frequency hopping, are separated by 200 kHz.

Frequency Hopping Band Settings

Channel Setting	Bands	Hopping
A1	Sub-band “A”: 2402.0–2406.8 MHz	Frequency Hopping
B1	Sub-band “B”: 2407.0–2411.8 MHz	Frequency Hopping
C1	Sub-band “C”: 2412.0–2416.8 MHz	Frequency Hopping
D1	Sub-band “D”: 2417.0–2421.8 MHz	Frequency Hopping
E1	Sub-band “E”: 2422.0–2426.8 MHz	Frequency Hopping

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Channel Setting	Bands	Hopping
F1	Sub-band “F”: 2427.0–2431.8 MHz	Frequency Hopping
G1	Sub-band “G”: 2432.0–2436.8 MHz	Frequency Hopping
H1	Sub-band “H”: 2437.0–2441.8 MHz	Frequency Hopping
I1	Sub-band “I”: 2442.0–2446.8 MHz	Frequency Hopping
J1	Sub-band “J”: 2447.0–2451.8 MHz	Frequency Hopping
K1	Sub-band “K”: 2452.0–2455.8 MHz	Frequency Hopping
L1	Sub-band “L”: 2457.0–2461.8 MHz	Frequency Hopping
M1	Sub-band “M”: 2462.0–2466.8 MHz	Frequency Hopping
N1	Sub-band “N”: 2467.0–2471.8 MHz	Frequency Hopping
O1	Sub-band “O”: 2472.0–2476.8 MHz	Frequency Hopping
P1	Sub-band “P”: 2477.0–2481.8 MHz	Frequency Hopping
A2	Sub-band “A”: 2402.0–2406.8 MHz	Adaptive Frequency Hopping
B2	Sub-band “B”: 2407.0–2411.8 MHz	Adaptive Frequency Hopping
C2	Sub-band “C”: 2412.0–2416.8 MHz	Adaptive Frequency Hopping
D2	Sub-band “D”: 2417.0–2421.8 MHz	Adaptive Frequency Hopping
E2	Sub-band “E”: 2422.0–2426.8 MHz	Adaptive Frequency Hopping
F2	Sub-band “F”: 2427.0–2431.8 MHz	Adaptive Frequency Hopping
G2	Sub-band “G”: 2432.0–2436.8 MHz	Adaptive Frequency Hopping
H2	Sub-band “H”: 2437.0–2441.8 MHz	Adaptive Frequency Hopping
I2	Sub-band “I”: 2442.0–2446.8 MHz	Adaptive Frequency Hopping
J2	Sub-band “J”: 2447.0–2451.8 MHz	Adaptive Frequency Hopping
K2	Sub-band “K”: 2452.0–2455.8 MHz	Adaptive Frequency Hopping
L2	Sub-band “L”: 2457.0–2461.8 MHz	Adaptive Frequency Hopping
M2	Sub-band “M”: 2462.0–2466.8 MHz	Adaptive Frequency Hopping
N2	Sub-band “N”: 2467.0–2471.8 MHz	Adaptive Frequency Hopping
O2	Sub-band “O”: 2472.0–2476.8 MHz	Adaptive Frequency Hopping
P2	Sub-band “P”: 2477.0–2481.8 MHz	Adaptive Frequency Hopping
01 or 02	Bands G,H,I,J,K,L	Frequency Hopping
03 or 04	Bands G,H,I,J,K,L	Adaptive Frequency Hopping
98	All bands	Frequency Hopping
99	All bands	Adaptive Frequency Hopping

Table 6.8: Frequency hopping band settings

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R(number,1)

The letter “R” followed by exactly 1 digit sets the read range of the reader. Numbers between 1-4 and A-J are possible, where 1 defines the shortest read range and 4 sets the longest read range. The read range can be set in 10% increments using the settings A (10%) up to J (100%). Range 4 and J have the same range.

Range Setting	% of Maximum Distance
1	1%
2	33%
3	66%
4	100%
A	10%
B	20%
C	30%
D	40%
E	50%
F	60%
G	70%
H	80%
I	90%
J	100%

Table 6.9: Range settings

B(number,1)

The letter “B” followed by exactly 1 digit sets the baud rate for both serial ports and the port 2 RS 485 mode. Because 2-wire mode is half-duplex; data collisions are possible. The possible settings are:

Setting	Baud rate [bps]	Port 1 setting	Port 2 setting	Port 2 mode
B0 or B8	4 800	RS 232	RS 485	4-wire
B1 or B9	9 600	RS 232	RS 485	4-wire
B2 or BA	19 200	RS 232	RS 485	4-wire
B3	38 400	RS 232	RS 485	4-wire
B4	57 600	RS 232	RS 485	4-wire
BB	115 200	RS 232	RS 485	4-wire
B5	4 800	RS 232	RS 485	2-wire
B6	9 600	RS 232	RS 485	2-wire
B7	19 200	RS 232	RS 485	2-wire
BC	38 400	RS 232	RS 485	2-wire
BD	57 600	RS 232	RS 485	2-wire

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Setting	Baud rate [bps]	Port 1 setting	Port 2 setting	Port 2 mode
BE	115 200	RS 232	RS 485	2-wire

Table 6.10: Baud rate settings

L(xn,2)

The length and data format can be set using the letter L followed by the letter F or V and length.

Fn indicates fixed format. The number of characters sent for barcode emulation port is fixed to n. Shorter tag data (i.e. fewer digits) is preceded by 0ASCII characters. Longer tag data (i.e. more digits) is truncate after n digits. For quarter and full memory tags n digits are always sent. The remaining bytes are truncated.

F8 is a special case where only the MARK is read off read/write tags and read only tags. The data starts with : and is followed by an 8 digit MARK. Example :12345678<CR>

FA is a special case where the entire tag data is sent and the MARK is sent afterwards. The datasets are separated by "**:**."

- MARK only tags - return 9 characters on port 1 and 14 characters on 2
- MINI memory tags - return 11 characters
- QUARTER memory tags - return 28 characters
- FULL memory tags - return 80 characters

V indicates variable format. The number of characters sent for barcode emulation port depends on n. If the tag data is shorter (i.e., has fewer digits), only the necessary characters are sent. Longer tag data (i.e. more digits) is truncated after n digits. n is a length specification between 1 and 5. For quarter and full memory tags n digits are always sent. The remaining bytes are truncated.

xx length specifier can also be Lxx where xx is the fixed length of data to be sent.

The read only (MTO) tags always have a fixed format of "**:**" and 8 characters.

Example:

Format	Number on Tag	Data sent when triggered
LF4	12	0012
	945	0945
	11 018	1018
LV4	12	12
	945	945
	11 018	1018
LF2	12	12
	945	45
	11 018	18
LV2	12	12
	945	45
	11 018	18

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Format	Number on Tag	Data sent when triggered
L20	12 (Mini)	00000000000000000012
	abcdefghijklmnopqrs (Quarter)	Abcdefghijklmnopqrs<0x00>
	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxx (Full)	xxxxxxxxxxxxxxxxxxx
MTO tags	:12018628 (Read only, MTO)	:12018628
LF8	:12018628 (Any tag)	:12018628
LFA	12 (Mini)	00012:01474380
	abcdefghijklmnopqrs (Quarter)	Abcdefghijklmnopqrs: 01474380
	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxx:01474380 (Full)	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxx:01474380

Table 6.11: Data format

T(ASCII,2)

The letter T followed by two ASCII characters specifies the hex value for the postamble.

Example:

- T0D specifies a <CR> trailer as postamble
- T00 specifies that no postamble is sent

H(ASCII,2)

The letter H followed by two ASCII characters specifies the hex value for the preamble.

Example:

- H0A specifies a <LF> header as preamble
- H00 specifies that no preamble is sent

X(ASCII,2)

The letter X followed by two ASCII characters specifies the hex value for the handshake character. The handshake confirms that a command has been sent and received by the reader. This character is sent after a command (“LON”, “LOFF”, “g”) was received.

Example:

- X21 specifies a ! as the hand shake character
- X00 specifies that no hand shaking is used

M(number,1)

The letter M followed by exactly 1 digit sets the number of different tags, that are read before the reading stops. A value of zero indicates that the reader starts scanning at power-up. The LON and LOFF commands are not executed.

Example:

- M1 specifies that reading tags stops after one tag has been read

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- M0 specifies that reading always takes place.

  LON and LOFF are ignored

A(ASCII,1)

The letter A followed by one ASCII characters specifies the type of heartbeat.

Example:

- A0 specifies the no heartbeat will be used
- A1 specifies that an unsolicited heartbeat (1 min) will be used
- A2 specifies that an unsolicited heartbeat (1 min) with handshake will be used

6.4.3 Data Format for each Mode

Standard Mode

The format of the data and the responses to the various commands are as follows.

Tag moves over reader, no trigger or command sent

The length of the data will depend on the size of the memory of the tag. Two bytes are sent for mini, 18 bytes for quarter and 71 bytes for full memory tags. Read only tag data with the length of 9 bytes is preceeded by a colon.

Command	No command sent
Mini/quarter/full memory tag read:	
Response:	Port 1 and 2 = <Data_Binary_Variable>(Bit 6 set if low battery on mini memory tags)
Read only MTO tag read	
Response:	Port 1 and 2 = :<Data_ASCII_DEC>

Input 1 triggered or G<CR> command sent, requests the last dataset sent

The response sends the data, that was sent to the previous tag by the reader. If no tag has been read since boot up, then the <0xBF><0xFF> message is sent. The length of the data will depend on the size of the memory of the tag. Two bytes are sent for mini, 18 bytes for quarter and 71 bytes for full memory tags. Read only tag data with the length of 9 bytes is preceeded by a colon.

Command	G<CR> or rising edge input 1
Mini/quarter/full memory tag read:	
Response:	Port 1 and 2 = <Data_Binary_Variable> (Bit 6 low bat, bit 7 on for mini)
Read only MTO tag read	
Response:	Port 1 and 2 = :<Data_ASCII_DEC>
No tag read since boot up	
Response:	Port 1 and 2 = <0xBF><0xFF>

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Input 2 triggered or N<CR> command sent, reread tag

Data is only sent if the tag is within the reach of the reader. If there is no tag within the reach of the reader the <0xBF><0xFF> response is sent. The length of the data will depend on the size of the memory of the tag. Two bytes are sent for mini, 18 bytes for quarter and 71 bytes for full memory tags. Read only tag data with the length of 9 bytes is preceeded by a colon.

Command N<CR> or rising edge input 2

Mini/quarter/full memory tag read:

Response: Port 1 = <Data_Binary_Variable> (Bit 6 low bat, bit 7 on for mini)
Port 2 = <Data_Binary_Variable> (Bit 6 low bat on mini)

Read only MTO tag read

Response: Port 1 and 2 = :<Data_ASCII_DEC>

No tag within reach

Response: Port 1 and 2 = <0xBF><0xFF>

F<CR> command sent, requests the last data set sent and includes tag format

The response sends the data, that was sent to the previous tag by the reader. The tag format is appended to the end of the string. If no tag has been read since boot up then the <0xBF><0xFF>?? response is sent. The length of the data will depend on the size of the memory of the tag. Two bytes are sent for mini, 18 bytes for quarter and 71 bytes for full memory tags. Read only tag data with the length of 9 bytes is preceeded by a colon.

Command F<CR>

Mini/quarter/full memory tag read:

Response: Port 1 and 2 = <Data_Binary_Variable><Format> (Bit 6 low bat, bit 7 on for mini)

Read only MTO tag read

Response: Port 1 and 2 = :<Data_ASCII_DEC>R8

No tag read since bootup

Response: Port 1 and 2 = <0xBF><0xFF>??

Enhanced Mode

Enhanced mode will add formatting to the mini memory data and will allow the data to have a fixed length out of port 2.

Data format of tags with no triggers

Port 1 will send data immediately when the tag arrives in field.

Port 2 won't send data.

Command No command sent

Mini/quarter/full memory tag read:

Response: Port 1 = <Data_Binary_Variable> (Bit 6 set if low battery on mini tags)
Port 2 = -

Read only MTO tag read or all tags when LF8 string format is specified

Response: Port 1 = : <Data_ASCII_DEC>
Port 2 = -

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Input 1 triggered or G<CR> command sent, send last tag read to port 1 and only send to port 2 if tag is currently within reach of reader

Port 1 will send the last data set that was sent by the reader.

Port 2 will only send the tag data that is within the reach of the reader.

Command G<CR> or rising edge input 1

Mini memory tag read:

Response: Port 1 = <Data_Binary_ Variable><TERM> (Bit 6 low bat, bit 7 on for mini)
Port 2 =<Data_ASCII_DEC><TERM>(Length Formatted by Lxx parameter)

Quarter/full memory tag read:

Response: Port 1 = <Data_Binary_Variable><TERM>
Port 2 = <Data_Binary_Fixed><TERM> (length specified by Lxx parameter)

Read only MTO tag read or all tags when LF8 string format is specified

Response: Port 1 and 2 =:<Data_ASCII_DEC><TERM>

No tag read since boot up

Response: Port 1 = <0xBF><0xFF><TERM>
Port 2 = -

Input 2 triggered or N<CR> command, reread tag

Data is only sent if the tag is within the reach of the reader. If there is no tag within the reach of the reader the <0xBF><0xFF><TERM> response is sent. The length of the data will depend on the size of the memory of the tag. Two bytes are sent for mini, 18 bytes for quarter and 71 bytes for full memory tags. Read only tag data with the length of 9 bytes is preceeded by a colon.

Command N<CR> or rising edge input 2

Mini/quarter/full memory tag read:

Response: Port 1 = <Data_Binary_Variable> (Bit 6 set if low battery on mini tags)
Port 2 = -

Read only MTO tag or all tags when LF8 is specified read

Response: Port 1 = : <Data_ASCII_DEC
Port 2 = -

No tag within reach

Response: Port 1 = <0xBF><0xFF><TERM>(3)
Port 2 = -

F<CR> command sent, requests the last dataset sent and includes tag format

The response sends the data, that was sent to the previous tag by the reader. The tag format is appended to the end of the string. If no tag has been read since boot up then the <0xBF><0xFF><TERM>?? response is sent. The length of the data will depend on the size of the memory of the tag. Two bytes are sent for mini, 18 bytes for quarter and 71 bytes for full memory tags. Read only tag data with the length of 9 bytes is preceeded by a colon. The length is specified by Lxx parameter except when reading the Mark.

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Command F<CR>

Mini memory tag read:

Response: Port 1 = <Data_Binary_Variable><TERM><Format> (Bit 6 low bat, bit 7 on for mini)
Port 2 = <Data_ASCII_DEC><TERM>

Quarter/full memory tag read:

Response: Port 1 = <Data_Binary_Variable><TERM><Format>
Port 2 = <Data_Binary_Fixed><TERM>

Read only MTO tag read or all tags when LF8 is specified

Response: Port 1 = :<Data_ASCII_DEC><TERM><Format>
Port 2 = :<Data_ASCII_DEC><TERM>

No tag read since bootup

Response: Port 1 = <0xBF><0xFF><TERM>??
Port 2 = -

Track Mode

Track mode is designed to completely emulate a barcode reader. The preamble and termination characters are optional and the length is specified by the L parameter. The reader can be turned on using the LON and LOFF commands. If M=0 then data is sent immediately when the tag arrives. If M NOT 0 then LON must be sent before tags will be sent to the ports. The value of M is the number of different tags, that can be read (up to 9) before the reader will no longer respond with tag data. LOF can be sent anytime to terminate reads. LON must be resent, when the number of tags reaches the number M or the LOFF was sent.

Data format of tags with no triggers

Data is sent out of the serial ports automatically when LON has been sent, or the M parameter is 0. Length is specified by Lxx parameter, except when reading the Mark.

Command No command sent

Mini memory tag read:

Response: Port 1and 2 = <HEAD><Data_ASCII_DEC><TERM>

Quarter/full memory tag read:

Response: Port 1 and 2 = <HEAD><Data_Binary_Fixed><TERM>

Read only MTO tag read or all tags when LF8 string format is specified

Response: Port 1 and 2 = <HEAD>:<Data_ASCII_DEC><TERM>

Input 1 triggered or G<CR> command sent, request last data sent

The last tag read is sent out of both serial ports. Length is specified by Lxx parameter except when reading the Mark.

Command G<CR> or rising edge input 1

Mini memory tag read:

Response: Port 1and 2 = <HEAD><Data_ASCII_DEC><TERM>

Quarter/full memory tag read:

Response: Port 1 and 2 = <HEAD><Data_Binary_Fixed><TERM>

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Read only MTO tag read or all tags when LF8 string format is specified

Response: Port 1 and 2 = <HEAD>:<Data_ASCII_DEC><TERM>

No tag read since boot up

Response: Port 1 and 2 =<HEAD>00000000…<TERM>
Port 1 and 2 =<HEAD>:00000000<TERM> (with F8 specified)
Port 1 and 2 =<HEAD>00000:00000000<TERM> (with FA specified)

Input 2 triggered or N<CR> command, reread tag

Any tag that is within reach of the reader is sent out of the ports. It doesn't matter if LON was sent or that the communicator is reading tags. Length is specified by Lxx parameter except when reading the Mark.

Command N<CR> or rising edge input 2

Mini memory tag read:

Response: Port 1and 2 = <HEAD><Data_ASCII_DEC><TERM>

Quarter/full memory tag read:

Response: Port 1 and 2 = <HEAD><Data_Binary_Fixed><TERM>

Read only MTO tag or all tags when LF8 is specified read

Response: Port 1 and 2 = <HEAD>:<Data_ASCII_DEC><TERM>

No tag within reach

Response: Port 1 and 2 =<HEAD>00000000…<TERM>
Port 1 and 2 =<HEAD>:00000000<TERM> (with F8 specified)
Port 1 and 2 =<HEAD>00000:00000000<TERM> (with FA specified)

F<CR> command sent, requests the last dataset sent and includes tag format

The responses are sent of the last tag that was within reach of the reader. The tag format is appended to the end of the string. If no tag has been read since boot up, a fixed length of "0" is sent. Length is specified by Lxx parameter except when reading the Mark.

Command F<CR>

Mini memory tag read:

Response: Port 1and 2 = <HEAD><Data_ASCII_DEC><TERM><Format>

Quarter/full memory tag read:

Response: Port 1 and 2 = <HEAD><Data_Binary_Fixed><TERM><Format>

Read only MTO tag read or all tags when LF8 is specified

Response: Port 1 and 2 = <HEAD>:<Data_ASCII_DEC><TERM><Format>

No tag read since bootup

Response: Port 1 and 2 =<HEAD>00000000…<TERM>??
Port 1 and 2 =<HEAD>:00000000<TERM>?? (with F8 specified)
Port 1 and 2 =<HEAD>00000:00000000<TERM>?? (with FA specified)

Universal Mode

The universal mode operation adds additional control over the data received from the reader. In universal mode, it is possible to buffer a settable number of tags and request either the last read tag data or all buffered tag data. The tag data buffer is FIFO.

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A heartbeat function has been implemented and is optional. If no other data exchange (via the serial interface) has occurred for one minute, the reader sends an a heartbeat string. This is used to verify that the reader is still powered up and communicating.

Data format of tags with no triggers

Data is sent out of the serial ports automatically when LON has been sent, or M parameter is 0. Length is specified by Lxx parameter except when reading the Mark.

Command No command sent

Mini memory tag read:

Response: Port 1and 2 = <HEAD><Status><Data_ASCII_DEC><TERM>

Quarter/full memory tag read:

Response: Port 1 and 2 = <HEAD><Status><Data_Binary_Fixed><TERM>

Read only MTO tag read or all tags when LF8 string format is specified

Response: Port 1 and 2 = <HEAD>:<Status><Data_ASCII_DEC><TERM>

Input 1 triggered or G<CR> command sent, request last data set

The last tag read is sent out of both serial ports. Length is specified by Lxx parameter except when reading the Mark.

Command G<CR> or rising edge input 1

Mini memory tag read:

Response: Port 1and 2 = <HEAD>H<Data_ASCII_DEC><TERM>

Quarter/full memory tag read:

Response: Port 1 and 2 = <HEAD>H<Data_Binary_Fixed><TERM>

Read only MTO tag read or all tags when LF8 string format is specified

Response: Port 1 and 2 = <HEAD>H:<Data_ASCII_DEC><TERM>

No tag read since boot up

Response: Port 1 and 2 =<HEAD>500000000…<TERM>
Port 1 and 2 =<HEAD>5:00000000<TERM> (with F8 specified)
Port 1 and 2 =<HEAD>500000:00000000<TERM> (with FA specified)

Input 2 triggered or N<CR> command, reread tag

Any tag that is within reach of the reader is sent out of the ports. It doesn't matter if LON was sent or if the reader is reading tags. Length is specified by Lxx parameter except when reading the Mark.

Command N<CR> or rising edge input 2

Mini memory tag read:

Response: Port 1and 2 = <HEAD><Status><Data_ASCII_DEC><TERM>

Quarter/full memory tag read:

Response: Port 1 and 2 = <HEAD><Status><Data_Binary_Fixed><TERM>

Read only MTO tag or all tags when LF8 is specified read

Response: Port 1 and 2 = <HEAD><Status>:<Data_ASCII_DEC><TERM>

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No tag within reach

Response: Port 1 and 2 =<HEAD>500000000…<TERM>
Port 1 and 2 =<HEAD>:500000000<TERM> (with F8 specified)
Port 1 and 2 =<HEAD>500000:00000000<TERM> (with FA specified)

F<CR> command sent, requests the last dataset sent and includes tag format

The responses of the last tag within reach of the reader are sent. The tag format is appended to the end of the string. If no tag has been read since boot up, a fixed length of “0” is sent. Length is specified by Lxx parameter except when reading the Mark.

Command F<CR>

Mini memory tag read:

Response: Port 1and 2 = <HEAD>H<Data_ASCII_DEC><TERM><Format>

Quarter/full memory tag read:

Response: Port 1 and 2 = <HEAD>H<Data_Binary_Fixed><TERM><Format>

Read only MTO tag read or all tags when LF8 is specified

Response: Port 1 and 2 = <HEAD>H:<Data_ASCII_DEC><TERM><Format>

No tag read since bootup

Response: Port 1 and 2 =<HEAD>50000000…<TERM>??
Port 1 and 2 =<HEAD>5:00000000<TERM>?? (with F8 specified)
Port 1 and 2 =<HEAD>500000:00000000<TERM>?? (with FA specified)

Input 3 triggered or A<CR> sent, Request all buffered data

All previously read tags (up to 10) are sent out of the serial ports with a 500 ms gap between each one. After the last tag is sent, an end of buffer message is sent. The length of each response is specified by Lxx parameter except when reading the Mark. Once the response has been sent, the buffer is cleared.

Command A<CR> or rising edge of input 3

Mini memory tag read:

Response: Port 1and 2 = <HEAD>H<Data_ASCII_DEC><TERM>

Quarter/full memory tag read:

Response: Port 1 and 2 = <HEAD>H<Data_Binary_Fixed><TERM>

Read only MTO tag read or all tags when LF8 is specified

Response: Port 1 and 2 = <HEAD>H:<Data_ASCII_DEC><TERM>

No tag read since bootup

Response: Port 1 and 2 =<HEAD>5##…<TERM>
Port 1 and 2 =<HEAD>5#########<TERM> (with F8 specified)
Port 1 and 2 =<HEAD>5#<TERM> (with FA, Vx specified)

Heartbeat

To determine the state of the serial interface between reader and control PC, the ‘H’ character is used to indicate the heartbeat. The length of the heartbeat is identical to the configured length of the data. In fixed length mode F1-F5, the exact number of characters including head and trailer will be sent. In all other cases only one byte will be sent.

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Heartbeat mode 0	disables the heartbeat
Heartbeat mode 1	enables the 1-minute heartbeat
Heartbeat mode 2	enables the 1-minute heartbeat and expects a user acknowledge. In this mode the control PC must reply by sending a single H<CR> back to the reader. If this string is not received within 1 second, the reader indicates this by toggling the main LED between RED and AMBER (frequency 1 second). The reader continues to operate normally. Toggling the main LED is stopped as soon as the control PC sends the heartbeat data handshake reply.

Heartbeat mode 1

Sent by reader automatically

Heartbeat:	<HEAD>0H…<TERM>
Response:	-

Heartbeat mode 2

Sent by reader automatically

Heartbeat:	<HEAD>0H…<TERM>
Response:	H<CR>

The heartbeat handshake H<CR> may be sent anytime to reset the heartbeat timer.

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7 Operation

7.1 Application – Firmware ‘P+F_MONITOR

Introduction

The MTT3000-F180-B12-V45-MON comes with a P+F specific monitor software. This software has been designed to fit many specific customer needs. It can be configured for 4 different modes of operation. These Modes of operation are: standard, enhanced, track and universal mode. Read through the specific features and benefits of each mode to determine how you want to configure your reader.

Standard mode

This basic mode of operation is used to read and send data back to the various connected ports.

- 2 bytes, 19 bytes, or 71 bytes of binary coded data
- MTO read only tags supported
- No formatting
- Hardware or software triggers can be used to resend data or reread tags

Enhanced mode

This extension of the basic mode allows for the formatting of tag data and a termination character to be specified. Formatted data is only sent on hardware trigger of input 1 to port 2. Port 2 data is only sent when tag is over reader and a trigger occurs on input 1.

- 2 bytes, 19 bytes, or 71 bytes of binary coded data sent out port 1
- MTO read only tags supported
- Fixed or variable length data sent out port 2
- Specification of termination character on port 2
- Data on port 2 only sent when tag is over reader and there is a trigger on input 1

Track mode

This mode of operation uses features of the enhanced mode but with additional parameters to further emulate a barcode reader.

- The same formatted data is sent out both ports
- MTO read only tags supported
- Data length can be specified
- Specifying of termination character is possible
- Specifying of prefix character is possible
- LON and LOFF barcode read commands implemented, Optional. LON turns reader on for reading of 1 up to 9 different tags. LOFF can be sent any time to turn off reading.(M1 to M9 parameter only)
- Optional acknowledge character can be specified in response to LON and LOFF commands

Universal mode

Some additional control over the serial data is now possible. This includes a status byte preceding the data, a heartbeat, and the storing of buffered data.

- The same formatted data is sent out both ports

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- MTO read only tags supported
- Data length can be specified
- Specifying of termination character possible
- Specifying of prefix character possible
- LON and LOFF barcode read commands implemented, Optional. Turns on and off reading of tags.
- Status byte proceeds tag data string
- Request Buffer command. Will return the last 10 tags read
- Heartbeat can be sent at regular intervals with/without acknowledge

7.2 Tag data format

All tags, except read only tags, are formatted during the write data operation. The tag is written completely every time. It is not possible to write only part of the tag while leaving some data unchanged. If some data is not to change, read the entire tag first, change the data and then write back the entire tag. There are three memory models for the MTM type tags. The data can be 2 bytes long, 19 bytes long or 71 bytes long. Depending on the reader mode, setting the length of the data can be truncated to smaller more manageable fixed length sizes.

Quarter and full memory tags

Any length of 19 bytes or less will be formatted to quarter memory. 20 bytes and higher is full memory. The smaller the memory model, the faster the data can be sent to the reader. Mini memory is faster then quarter memory, which is faster the full memory. If a length, that is smaller then the memory it is specified to, i. e. quarter or full memory, then the remaining bytes are filled with NULL 0x00.

7.2.1 Memory length options

During the write operation the tag format is also specified. The interval type is set to R for random and C for constant. This means that the time between successive data sent from the tag is at a constant time interval or a random time interval. Random should always be used, if multiple tags in field are expected. C should be used for the quickest response times. The interval length is then specified at 0, 4, 8, or 16. The time interval is 4, 8, or 16 times as long as the actual time it takes to send the data. The longer the interval, the more likely you will be able to read more tags in field and also the longer the battery life.

Memory model	Length	Data range	Data type	Write length
Mini memory	2	0 to 16383	ASCII	1 to 5
Quarter memory	19	19 bytes	Binary/ASCII	001 - 019
Full memory	71	71 bytes	Binary/ASCII	001 - 071
MTO read only	9	00000000 to 999999999	ASCII	-

Table 7.1: Memory length options

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7.2.2 Format options

Tag format	Interval type	Interval length	~multiple tags in field
C0	C	0	0
C4	C	4	0
C8	C	8	0
C16	C	16	0
R4	R	0 to 8	~4
R8	R	0 to 16	~8
R16	R	0 to 32	~8

Table 7.2: Tag Data Format options

7.2.3 Read/Write speed and battery life

Tag size	Format	Read time [ms]	Write time 99.99% [ms]	Battery life
Mini	C0	50	600	6
Mini	C4	100	800	6
Mini	C8	170	2100	10
Mini	C16	300	-	10
Quarter	C0	70	800	6
Quarter	C4	180	2300	9
Quarter	C8	350	4800	10
Quarter	C16	540	-	10
Full	C0	140	3000	6
Full	C4	370	6000	9
Full	C8	750	-	10
Full	C16	1110	-	10
MTO tags	Random	150 max, 80 average	-	10

Table 7.3: Read/Write speed / battery life

7.3 Writing Data(The MTT3000-F180-B12-V45-MON can't write!)

When writing data to a tag, only one tag is allowed to be within the entire maximum read zone. If there are multiple tags in the field, a write will not be performed. The write range is very short. The tag must be placed at a maximum of 0.25 m (0.8ft) from the reader. Do not take the tag out of the write range before the write is complete. The tag will lockup and a special procedure will be necessary to unlock the tag. The writing of tags can take some time. If no tag is in the read zone, the write will timeout after about 13 seconds.

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7.3.1 Writing Mini Memory Tags(The MTT3000-F180-B12-V45-MON can't write!)

Up to 2 bytes of data are formatted on the tag. The data is programmed in ASCII and can have any value from 0 up to 16383. A write attempt outside this range will result in a status 4 (bad command) returned. The length and tag format must also be specified. The length does not include the tag format or termination character.

Writing mini tags	Command	w<L1><Data_Ascii_DEC><Format><CR>
	Response	<Status><CR>
Example:	Command	w512345C8<CR>
	Response	0<CR> success
	Response	1<CR> success, low battery
	Response	4<CR> bad command, check string format
	Response	5<CR> no tag in field

7.3.2 Writing Quarter/Full Memory Tags(The MTT3000-... can't write!)

A three-character length is used to specify the write data length. Unlike the mini memory case, there is no restriction on the type of data that is written. The length does not include the tag format or termination character.

Writing quarter/full tags	Command	w<L3><Data_Binary><Format><CR>
	Response	<Status><CR>
Example:	Command	w019abcdefghijklmnopqrsC8<CR>
	Response	0<CR> success
	Response	1<CR> success, low battery
	Response	4<CR> bad command, check string format
	Response	5<CR> no tag in field (takes 13 seconds to return)

7.4 Ports

In this manual the ports are specified as port 1 or port 2 because on the reader and the data format may be different for each. The ports are defined as follows:

Port 1	RS 232 port connected at J42-1 and Ethernet TCP/IP port 10000
Port 2	RS 485 port connected at J41.1 and Ethernet TCP/IP port 10001

Ethernet Port 10006, an 8 digit number is sent out of the port every 2 seconds. It has a range from 00000002 to 99999999. On first boot up it starts at 00000002 and increments by 2 every 2 seconds. If the unit never shuts off it will take over 3.17 years to roll over.

Sending Commands

Commands used to configure and use this reader are simple. A serial timeout is used to determine which commands are valid. The entire command must arrive within 200 ms for the command to be valid. If not, an error code 4<CR> will be sent. Single character commands are easy enough to send from the keyboard but all other commands should be sent from a text file or custom application.

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7.5 Boot-up string

On power up, the communicator will send the model number and version information as well as the current loaded configuration. If the data looks corrupt, you might be connected at the wrong baud rate. Check all possible baud rates of 4800, 9600, 19200, 38400, 57600, and 115200 on your terminal program power cycling after each change. The default is 9600 bps. The communicator will take about 30 s to boot.

Here is an example of the boot-up data:

(C)P+F IDENT-M

MTT3000-F180-B12-V45-MON

#912231

1180055

19.03.10

SMDeskC98R4B1

7.6 Inputs and Outputs

The inputs are used to trigger a specific response from the reader. These responses are documented in the different modes Standard, Enhanced, Track, and Universal. The outputs are used to indicate to the user, that data is being sent to the serial ports in a specific way.

Input 1:

Used to send the last read tag to the serial port or the tag that is over the reader in Enhanced mode.

Input 2:

Used to perform a reread of the tag data. Because tag data is sent only when an actual tag is over the reader the output is sent when a tag is read and sent to the serial port.

Input 3:

In Standard, Enhanced and Track mode: Sending of data is suppressed to all ports if input is '1'.

In Universal mode the reader will respond with a list of all tags previously read up to 10. Once read, the buffer is cleared. The output does not turn on, when this data is sent to both serial ports.

Output 1:

Turns on for 100 ms when new tag data is sent

Output 2:

Turns on for 100 ms when new tag data is sent, same as output 1

Relay output:

Turns on when a tag with low battery is read, independent of other outputs

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7.7 Setting the IP address

If you plan on using the Ethernet ports, you will need to set the IP address and subnet mask. The units come with a default IP address of 192.168.0.2 and a subnet mask of 255.255.255.0. If the IP address is not known, it can be interrogated via the serial service interface. Here the IP address can be changed temporarily, it is valid until a power reset. Afterwards the IP address and its parameters can be changed non volatile via the webbrowser to the desired values. All IP address settings take affect after a reboot. If you don't want the gateway set, just use 0.0.0.0 where the gateway should be. If you set the IP address to 0.0.0.0., the IP address is reset to the default of 192.168.0.2 and the subnet mask is reset to the default of 255.255.255.0. A gateway is only recognized as valid, when it is connected to your network while the hardware powers up.

Note!

When DHCP is used, this hardware will not run until a valid IP address has been assigned to the reader. If you enable DHCP while a DHCP server is missing, it is not possible to set the IP address using DHCP. Leave the DHCP server on the network at all times.

Example:

Connection via hyperterminal to RS 232 application interface

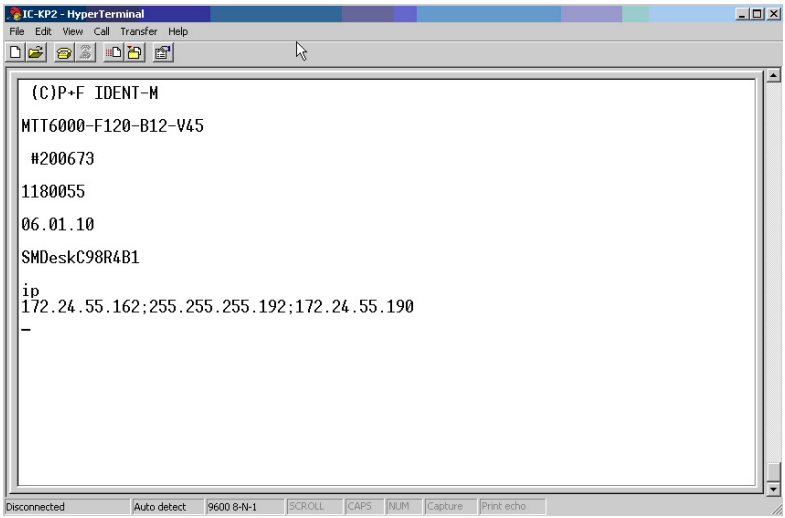

Figure 7.1: Connecting via hyperterminal

The switch on message of the reader appears. The command 'ip' is send from the computer. In the following line the response shows the current IP-address, subnet-mask and gateway-address. Now you can log on to the unit via a webbrowser using these addresses. You can change the adresses if desired.

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7.7.1 Reading the IP Address

	Command	IP<CR>
	Response	ipaddress;subnetmask;gateway<CR>
Example:	Command	IP<CR>
	Response	172.18.30.20;255.255.0.0; 172.18.0.55<CR>
Example (DHCP enabled):	Command	IP<CR>
	Response	DHCP enabled<CR><LF> 172.18.30.20;255.255.0.0; 172.18.0.55<CR>

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8 Maintenance

This chapter describes the maintenance procedure for the reader and how to solve the most common problems encountered during installation. If the reader malfunctions, contact the Pepperl+Fuchs support.

Never try to dismantle any components inside the reader. There are no components inside the reader that can be serviced by an installation engineer. Any such unauthorized alterations to the reader will invalidate the warranty.

8.1 Trouble Shooting

The following table describes the most common problems encountered during installation as well as adequate solutions.

Three system status indicators on the controller board inside the reader show the status of the unit. The table below explains the different indicator meanings.

Color	Mode	Meaning
Yellow	On	Power on
	Off	Power off
Green	Flashing	System SW running
	Initially on	System SW loading
	Off	System SW fault
Red	Flashing quickly	HW initiated and running
	On	Initiation process
	Off	HW not initiated

Table 8.1: System status indicators

The link state indicator and the activity indicator on the Ethernet connector inside the reader show the status of the network communication as explained in the table below.

Color	Mode	Meaning
Green	On	100 Mbps connection
	Off	10 Mbps connection
Yellow	Flashing	Present communication
	On	Link exists
	Off	No communication

Table 8.2: Ethernet indicators

The following table describes the most common problems encountered during installation and proposed solutions.

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Problem	Solution
Yellow system status indicator is off	Check the power supply.
Green system status indicator is off	Switch off the power supply, switch it on again, and wait 30 seconds. This can be done by pulling the J31 terminal block off the board and putting it back again. If the reader fails to start again, contact Pepperl+Fuchs support.
Red system status indicator is on or off	Switch off the power supply and switch it on again. This can be done by pulling the J31 terminal block off the board and putting it back again. If the reader fails to start again, contact Pepperl+Fuchs support.
Yellow Ethernet indicator is off	Check the network connection.

Table 8.3: Most common problems

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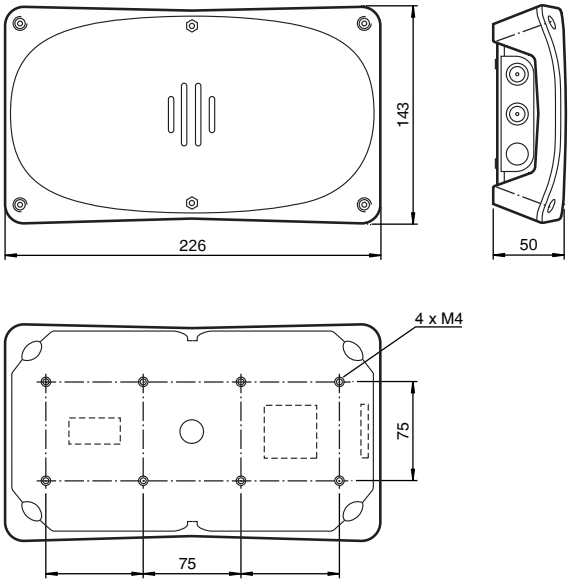
9 Appendix

9.1 Technical Data



General specifications	
Operating frequency	2.402 ... 2.482 GHz
Polarization	circular
Transfer rate	read: 4 kBit/s , 16 kBit/s
Operating distance	maximum: 3 m
Memory	
Type/Size	Flash 16 MByte RAM 32 MByte
Indicators/operating means	
LED green/yellow/red	depending on the operating mode
Electrical specifications	
Rated operational voltage	10 ... 30 V DC
Power consumption	typical 4.5 W max. 15 W

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Interface 1	
Physical	Ethernet
Protocol	TCP/IP
Transfer rate	10/100 MBit/s
Interface 2	
Physical	RS 232 or RS 485; for RS 485: full- (4-wire) or half-duplex (2-wire)
Protocol	ASCII
Transfer rate	1.2 ... 115.2 kBit/s
Input	
Optocoupler	3 inputs
Input level	ON: ≥ 2.4 V , max. 30 V OFF: ≥ 0 V , max. 0.2 V
Output	
Electronic	output 1: open-collector; 1 ... 30 V DC, max. 500 mA output 2: open-collector; 1 ... 30 V DC, max. 100 mA
Relay	switching current ≤ 2 A; P_{max} = 50 W switching voltage ≤ 220 V DC; 48 V AC
Compliance with standards and directives	
Directive conformity	
R&TTE Directive 1995/5/EC	EN 60950, IEC 60215, ETS 300683, ETS 300440
Standard conformity	
Protection degree	EN 60529
Ambient conditions	
Ambient temperature	-20 ... 60 °C (-4 ... 140 °F)
Storage temperature	-20 ... 60 °C (-4 ... 140 °F)
Mechanical specifications	
Protection degree	IP65
Material	Plastic
Mass	3 kg
Dimensions	226 mm x 143 mm x 50 mm (W x H x D)

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9.2 Glossary

The glossary lists abbreviations and acronyms used in this manual.

Term	Description
AWG	American Wire Gauge
CW	Continuous Wave
DC	Direct Current
DHCP	Dynamic Host Configuration Protocol, a protocol used by networked computers to obtain an IP address and other parameters
FCC	Federal Communications Commission
FHSS	Frequency-Hopping Spread Spectrum A spread-spectrum method of transmitting radio signals by rapidly switching a carrier among many frequency channels, using a pseudorandom sequence known to both transmitter and receiver
Host	The external intelligence, for instance workstation or server, which acts as master of a reader or a set of readers
ID-tag	ID-carrier in the Pepperl+Fuchs system, which is readable and writable via a radio interface
Magstripe	Card reading protocol used for reading magnetic stripe cards
multi-drop network	A network in which several readers are all connected via RS485 to the same host
PCB	Printed Circuit Board
Reader	MTT3000-F180-B12-V45-MON
Reader application software	The application software installed in the reader, defining the behaviour of the reader
Reader system software	The fundamental software and operating system installed in the reader
reading lobe	The space in front of the reader in which ID-tags are being read
RF	Radio Frequency
RFID	Radio Frequency Identification
SFTP	Secure File Transfer Protocol
SSH	Secure Shell Reader
tagd	background operating software
tagmod	Reader kernel module
TAGP	Reader network communication protocol
Tamper switch	Switch that detects unauthorized access to the unit
USB	Universal Serial Bus
Wiegand	Trade name for a technology used in card readers and sensors, particularly for access control applications

Table 9.1: Abbreviations & acronyms

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9.3 Legend of the P+F_MONITOR commands

<Data_Binary_Variable>

This binary coded data will have a variable length that depends on the format of the tag. Mini memory tags have a length of 2, quarter memory tags have a length of 19 and full memory tags have a length of 71.

<Data_Binary_Fixed>

This binary coded data will have a fixed length based on the Lxx parameter. LFx, LVx, and Lxx will have the data formatted to exactly that length of characters. If there are fewer characters on the tag, the string is padded with 0x00<NULL> for quarter/full memory tags. Mini tags are padded with a 0x30,"0". If the tag data is longer then the fixed length specified, the remaining data is truncated. LFA is a special variable length case, where the tag data, depending on the tag format, is followed by the mark.

<Data_Binary>

This binary coded data will be sent in bytes and can have a byte value between 0x00 and 0xFF. Any character can be sent.

<Data_ASCII_DEC>

This ASCII data will only contain the digits 1 - 9. Read only MTO tags will have 8 characters with a value from 00000000 to 99999999. Mini memory formatted data will have a value from 00000 to 16383. Depending on the variable of fixed length format, leading digits may be truncated.

<Format>

This is the format of tag that was configured when the write procedure was performed

C0	Constant interval of 0
C4	Constant interval length between frames of 4
C8	Constant interval length between frames of 8
C6	Constant interval length between frames of 16
R4	Random interval length between frames between 0 and 8
R8	Random interval length between frames between 0 and 16
R6	Random interval length between frames between 0 and 32

<L1>

This is a one character length used to write mini memory tags. Its value can be between 1 and 5 and is the length of data to follow.

<L3>

This is the 3 character length and could have a value from 001 to 071. It defines the no. of following characters before the <CR>.

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<CR>

This special character is a carriage return. It is a single character that has a decimal value of 13 or hex value of 0x0D. There is no linefeed included.

<0xBF><0xFF>

Two characters sent when no tag is within reach of the reader or no tag was read after boot-up. Check specific mode for details.

0	Success
1	Success, low battery, replace tag
5	No Tag
4	Bad Command

<HEAD>

Preamble character that is sent as the first character of a response. It is specified by the Hxx parameter. If H00 is used then no character is sent.

<TERM>

Postamble character that is sent as the last character of a response. It is specified by the Txx parameter. If T00 is used then **no** character is sent.

9.4 Channel/Frequency Mapping (TAGD Settings)

Reader models prior to MTT3000-F180-B12-V45-MON use a frequency channel allocation scheme that divides the frequency band into distinct channels separated by 300 kHz. The following table shows the corresponding frequency for each channel:

Ch	F [MHz]	Ch	F [MHz]	Ch	F [MHz]
1	2435.1	34	2445.0	67	2454.9
2	2435.4	35	2445.3	68	2455.2
3	2435.7	36	2445.6	69	2455.5
4	2436.0	37	2445.9	70	2455.8
5	2436.3	38	2446.2	71	2456.1
6	2436.6	39	2446.5	72	2456.4
7	2436.9	40	2446.8	73	2456.7
8	2437.2	41	2447.1	74	2457.0
9	2437.5	42	2447.4	75	2457.3
10	2437.8	43	2447.7	76	2457.6
11	2438.1	44	2448.0	77	2457.9
12	2438.4	45	2448.3	78	2458.2
13	2438.7	46	2448.6	79	2458.5
14	2439.0	47	2448.9	80	2458.8

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Ch	F [MHz]	Ch	F [MHz]	Ch	F [MHz]
15	2439.3	48	2449.2	81	2459.1
16	2439.6	49	2449.5	82	2459.4
17	2439.9	50	2449.8	83	2459.7
18	2440.2	51	2450.1	84	2460.0
19	2440.5	52	2450.4	85	2460.3
20	2440.8	53	2450.7	86	2460.6
21	2441.1	54	2451.0	87	2460.9
22	2441.4	55	2451.3	88	2461.2
23	2441.7	56	2451.6	89	2461.5
24	2442.0	57	2451.9	90	2461.8
25	2442.3	58	2452.2	91	2462.1
26	2442.6	59	2452.5	92	2462.4
27	2442.9	60	2452.8	93	2462.7
28	2443.2	61	2453.1	94	2463.0
29	2443.5	62	2453.4	95	2463.3
30	2443.8	63	2453.7	96	2463.6
31	2444.1	64	2454.0	97	2463.9
32	2444.4	65	2454.3	98	2464.2
33	2444.7	66	2454.6	99	2464.5
				100	2464.8

Table 9.2: Channel/frequency mapping

9.5 Fixed Frequency Channels used by P+F_MONITOR application software

Ch	F [GHz]	Ch	F [GHz]	Ch	F [GHz]
05	2.4362	36	2.4455	67	2.4548
06	2.4365	37	2.4458	68	2.4551
07	2.4368	38	2.4461	69	2.4554
08	2.4371	39	2.4464	70	2.4557
09	2.4374	40	2.4467	71	2.4560
10	2.4377	41	2.4470	72	2.4563
11	2.4380	42	2.4473	73	2.4566
12	2.4383	43	2.4476	74	2.4569
13	2.4386	44	2.4479	75	2.4572
14	2.4389	45	2.4482	76	2.4575
15	2.4392	46	2.4485	77	2.4578

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Ch	F [GHz]	Ch	F [GHz]	Ch	F [GHz]
16	2.4395	47	2.4488	78	2.4581
17	2.4398	48	2.4491	79	2.4584
18	2.4401	49	2.4494	80	2.4587
19	2.4404	50	2.4497	81	2.4590
20	2.4407	51	2.4500	82	2.4593
21	2.4410	52	2.4503	83	2.4596
22	2.4413	53	2.4506	84	2.4599
23	2.4416	54	2.4509	85	2.4602
24	2.4419	55	2.4512	86	2.4605
25	2.4422	56	2.4515	87	2.4608
26	2.4425	57	2.4518	88	2.4611
27	2.4428	58	2.4521	89	2.4614
28	2.4431	59	2.4524	90	2.4617
29	2.4434	60	2.4527	91	2.4620
30	2.4437	61	2.4530	92	2.4623
31	2.4440	62	2.4533	93	2.4626
32	2.4443	63	2.4536	94	2.4629
33	2.4446	64	2.4539	95	2.4632
34	2.4449	65	2.4542	96	2.4635
35	2.4452	66	2.4545	97	2.4638

Table 9.3: Channel/frequency mapping

9.6 Frequency Hopping Sub-bands

The following table shows the frequency ranges for the different sub-bands. These sub-bands can be selected for frequency hopping. The recommended range (G-L) is emphasized in the table.

Band	Frequency range [MHz]
A	2402-2407
B	2407-2412
C	2412-2417
D	2417-2422
E	2422-2427
F	2427-2432
G	**2432-2437**
H	**2437-2442**

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Band	Frequency range [MHz]
I	**2442-2447**
J	**2447-2452**
K	**2452-2457**
L	**2457-2462**
M	2462-2467
N	2467-2472
O	2472-2477
P	2477-2482

Table 9.4: Channel/corresponding frequency

To make it easy to avoid interference from WLAN systems, the sub-band frequencies have been selected to match the WLAN channels as shown in the table below.

WLAN channel	Reader sub-bands
1	A-D
2	B-E
3	C-F
4	D-G
5	E-H
6	F-I
7	G-J
8	H-K
9	I-L
10	J-M
11	K-N
12	L-O
13	M-P

Table 9.5: Band/WLAN channel

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9.7 ASCII table

hex	dec	ASCII	hex	dec	ASCII	hex	dec	ASCII	hex	dec	ASCII
00	0	NUL	**20**	**32**	**Space**	40	64	@	**60**	**96**	'
01	1	SOH	**21**	**33**	**!**	41	65	A	**61**	**97**	**a**
02	2	STX	**22**	**34**	**"**	42	66	B	**62**	**98**	**b**
03	3	ETX	**23**	**35**	**#**	43	67	C	**63**	**99**	**c**
04	4	EOT	**24**	**36**	**$**	44	68	D	**64**	**100**	**d**
05	5	ENQ	**25**	**37**	**%**	45	69	E	**65**	**101**	**e**
06	6	ACK	**26**	**38**	**&**	46	70	F	**66**	**102**	**f**
07	7	BEL	**27**	**39**	**'**	47	71	G	**67**	**103**	**g**
08	8	BS	**28**	**40**	**(**	48	72	H	**68**	**104**	**h**
09	9	HT	**29**	**41**	**)**	49	73	I	**69**	**105**	**I**
0A	10	LF	**2A**	**42**	*****	4A	74	J	**6A**	**106**	**j**
0B	11	VT	**2B**	**43**	**+**	4B	75	K	**6B**	**107**	**k**
0C	12	FF	**2C**	**44**	**,**	4C	76	L	**6C**	**108**	**I**
0D	13	CR	**2D**	**45**	**-**	4D	77	M	**6D**	**109**	**m**
0E	14	SO	**2E**	**46**	**.**	4E	78	N	**6E**	**110**	**n**
0F	15	SI	**2F**	**47**	**/**	4F	79	O	**6F**	**111**	**o**
10	16	DLE	**30**	**48**	**0**	50	80	P	**70**	**112**	**p**
11	17	DC1	**31**	**49**	**1**	51	81	Q	**71**	**113**	**q**
12	18	DC2	**32**	**50**	**2**	52	82	R	**72**	**114**	**r**
13	19	DC3	**33**	**51**	**3**	53	83	S	**73**	**115**	**s**
14	20	DC4	**34**	**52**	**4**	54	84	T	**74**	**116**	**t**
15	21	NAK	**35**	**53**	**5**	55	85	U	**75**	**117**	**u**
16	22	SYN	**36**	**54**	**6**	56	86	V	**76**	**118**	**v**
17	23	ETB	**37**	**55**	**7**	57	87	W	**77**	**119**	**w**
18	24	CAN	**38**	**56**	**8**	58	88	X	**78**	**120**	**x**
19	25	EM	**39**	**57**	**9**	59	89	Y	**79**	**121**	**y**
1A	26	SUB	**3A**	**58**	**:**	5A	90	Z	**7A**	**122**	**z**
1B	27	ESC	**3B**	**59**	**;**	5B	91	[	**7B**	**123**	**{**
1C	28	FS	**3C**	**60**	**<**	5C	92	\	**7C**	**124**	**|**
1D	29	GS	**3D**	**61**	**=**	5D	93	]	**7D**	**125**	**}**
1E	30	RS	**3E**	**62**	**>**	5E	94	^	**7E**	**126**	**~**
1F	31	US	**3F**	**63**	**?**	5F	95	_	**7F**	**127**	**DEL**

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Pepperl+Fuchs sets the standard in quality and innovative technology for the world of automation. Our expertise, dedication, and heritage of innovation have driven us to develop the largest and most versatile line of industrial sensor technologies and interface components in the world. With our global presence, reliable service, and flexible production facilities, Pepperl+Fuchs delivers complete solutions for your automation requirements – wherever you need us.

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