FACTORY AUTOMATION

Manual

Ident-M System T

MTT-S3, MTT-F52-S3, MTT6000-F51-S3

CE

PEPPERL+FUCHS

List of contents

Date of Issue 11.07.2002

Date of Issue 11.07.2002

1 Introduction

1.1 IDENT-M System T

IDENT-M System T is a microwave identification system used to detect and identify persons, vehicles or other targets within a specific area. It can be used for area monitoring, access control, vehicle identification, production-data processing or the automatic identification of objects with various orientations and paths of travel. It can also register the speed at which targets enter or depart the area of detection.

The MTT-S3, MTT-F52-S3 and MTT6000-F51-S3 microwave communicators are the heart of the IDENT-M System T identification system. They communicate with MTO-C1 or MTO-C2 code carriers and MTM-C1 or MTM-C2 data carriers. The communicators are configured using the new P+F-Talk standard protocol, which is functionally similar to the IDENT-I System P multidrop protocol.

The microwave communicators detect objects that are equipped with the code/data carriers by transmitting microwave signals, which are slightly altered by these tags. Information about the objects (location, speed, etc.) is based on how these tags alter the microwave signals. The communicators also establish a link between the code/data carriers and a higher level computer (industrial PC or PLC) that processes the resulting information.

1.2 Declaration of conformity

The devices MTT-S3, MTT-F52-S3 and MTT6000-F51-S3 of the microwave identification system IDENT-M System T have been developed and manufactured with regard to the applicable European standards and directives.

Note

An appropriate declaration of conformity can be demanded from the manufacturer.

The manufacturer of the product, Pepperl+Fuchs GmbH, D-68301 Mannheim, and its subsidiaries operates a certificated quality assurance system in accordance with ISO 9001.

CE

ISO9001

Date of Issue 11.07.2002

1.3 Type-examination certificate

CE 0413

Certificate

NOTIFIED BODY OPINION
According to R&TTE-Directive 1999/5/EC, Annex IV

Reference No. 0135144C

Wireless Identification System

Type designation	MTT-S1, MTT-S2, MTT-600-F51-S1, MTT-S3
Manufacturer	**Pepperl+Fuchs GmbH**
Brand name	IDENT-M system-T

Technical reference

EC type examination			No. 9738191C and 9844232C Issued by SEMKO
Article 3.1(a)	El. safety	EN 60 950 and 215	Report No. 0105187 Issued by SEMKO
Article 3.1(b)	EMC	ETS 300 683	Report No. 9611201D Issued by SEMKO
Article 3.2	Radio	ETS 300 440	Report No. 9552059 Issued by SEMKO

Notified body statement

The review of the Technical Construction File gives presumption of compliance for the above mentioned product with the essential requirements given in Article 3.1(a) El. Safety, 3.1(b) EMC and 3.2 radio of Directive 1999/5/EC.

ETL SEMKO hereby authorises the use of identification number 0413 on specific products where we have formally reviewed a Technical Construction File.

Notified Body: SEMKO AB, Communication Equipment *Place:* Kista - Stockholm

Signed: Lars-Olov Johansson *Date:* 30 August 2001

Lars-Olov johansson

SEMKO

ETS Intertek Testing Services ETL SEMKO

1.4 About this manual

The purpose of this manual is to assist the customer in the proper installation and operation of the MTT-S3, MTT-F52-S3 and MTT6000-F51-S3 communicators. It is also intended to serve as a reference for configuring these communicators using the P+F-Talk configuration protocol.

This manual is divided into four main sections; system description, installation, configuration and operation, and fault diagnostics. Each section also contains important notes and warnings to the customer, which are set apart from the general text by the symbols described below.

Date of Issue 11.07.2002

2 Symbols used in this document

The following symbols used throughout this manual indicate important information and warnings to the operator.

Warning

This symbol warns of danger.

If this instruction is not heeded, there is a danger of the injury or death of personnel and damage to property or even its destruction.

Attention

This symbol warns of a possible fault.

If the instruction given in this warning is not heeded, the device and any plant or systems connected to it could develop a fault or even fail completely.

Note

This symbol directs attention to important information.

This symbol warns wearers of pacemakers, hearing aids and other medicinal electronic implants and devices of interference resulting from electromagnetic radiation in the microwave range.

Date of Issue 11.07.2002

Date of Issue 11.07.2002

3 Safety

3.1 Intended use

The MTT-S3, MTT-F52-S3 and MTT6000-F51-S3 communicators are part of the Ident-M System T microwave identification system by Pepperl+Fuchs and communicate with code/data carriers offered in System T.

Personal and system safety cannot be guaranteed when using the microwave communicator in a manner inconsistent with its intended function.

Warning *The MTT-S3, MTT-F52-S3 and MTT6000-F51-S3 communicators may only be operated by trained personnel and in accordance with this operating manual.*

The microwave radiation generated by these devices is less than 50 mW (EIRP - Equivalent Isotropic Radio Power) and is below the allowable values specified by BAPT 211 ZV 037/2050, issued April 1997.

The communicators emit electromagnetic radiation when active and should therefore, not be used in certain areas. Individuals with hearing aids, pace makers, or other medical appliances are advised to consult their physicians prior to operating these communicators.

3.2 General safety instructions

Operating the devices in a manner that is inconsistent with the instructions of this manual will void any guarantee of safety and proper function.

Warning *Only qualified technicians are authorized to connect or service the devices while the system is powered.*

The device should be taken out of operation and properly disposed of to prevent accidental re-installation if a fault cannot be corrected.

Only the manufacturer is authorized to make repairs. Unauthorized device repairs or modifications will void all warranties.

The user assumes all responsibility for adhering to local safety regulations.

3.3 Functional safety/monitoring

The MTT-S3, MTT-F52-S3 and MTT6000-F51-S3 microwave communicators function using microprocessors. They are monitored internally for proper function or component failure. Functions can be monitored by way of the RS 232/RS 485 interface. For additional information, see "Fault diagnostics" in section 9.

Date of Issue 11.07.2002

Date of Issue 11.07.2002

4 System description

4.1 Shipment contents

Each shipment contains the following:

- 1 operating manual
- 1 MTT-□□-S3 communicator
- Mounting and installation accessories
- 3.5" diskette with test-software

Note

Code and data carriers are not included and must be purchased separately.

4.2 Applications

The IDENT-M System T microwave identification system is a highly efficient and reliable system for identifying persons, material and vehicles. The MTT-□□-S3 communicators are the primary components of this system and are used to detect the approach, presence and withdrawal of various objects, as well as the speed of these objects.

The system is controller independent and can accommodate multiple tags. It has efficient safety functions and can accurately transfer data between communicators and code/data carriers by microwave transmission.

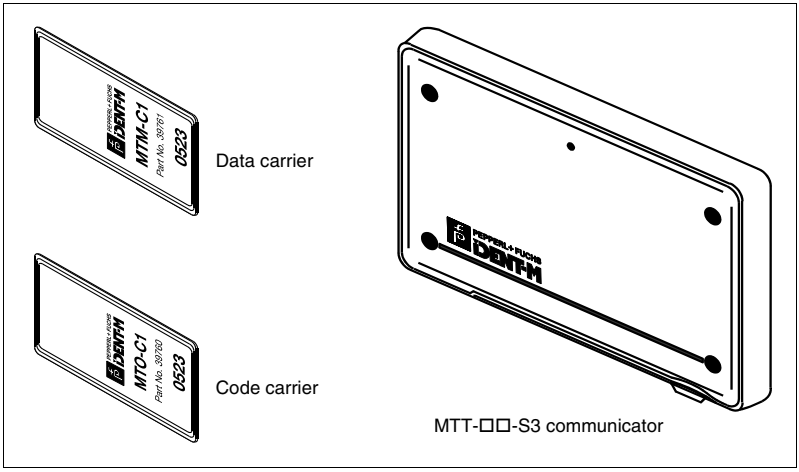


Bild 4.1: IDENT-M System T components

There are 99 channels available within a 2.45 GHz range allowing the installation of several communicators, which can communicate simultaneously with multiple code or data carriers.

Date of Issue 11.07.2002

The system is based on the conical emission of microwave radiation by the communicator. This microwave radiation is normally emitted as a uniform beam. As microwaves spread, they are dampened differently by objects made of various materials and are reflected e. g. by metal objects or metallic surfaces.

The microwave emitter's output allows the communicator to read code and data carriers at a distance of up to 6 m and to accurately write data carriers at a distance of up to 0.5 m. Motion can be detected at a distance of up to 8 m.

Typical applications include:

- Security, area monitoring and access control
- Vehicle identification and production-data storage within the automotive industry
- Identification of high-speed objects with variable orientations and paths of travel

4.3 System overview

The communicator establishes the connection between the code or data carriers of the IDENT-M system and a higher-level computer (industrial-PC, PLC, etc.).

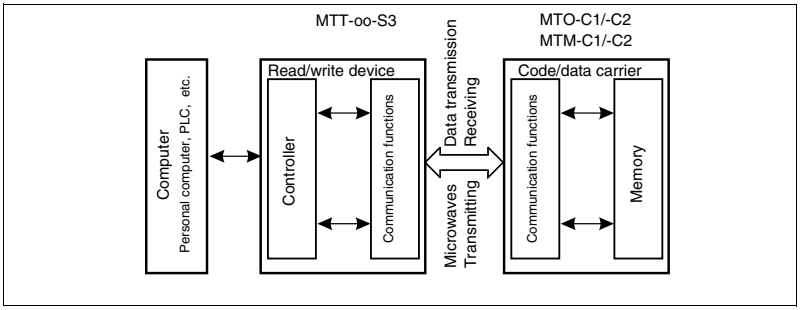


Bild 4.2: Communicator function within the overall system

To accomplish this, the communicator is equipped with the P+F-Talk serial protocol (at the interface to the computer).

Date of Issue 11.07.2002

The communicators are equipped with two serial interfaces; an RS 232 and a variable interface, which can function as either an RS 232 or as an RS 485 interface. Additional connections are possible using 3 digital inputs, 2 electronic outputs and 1 relay output.

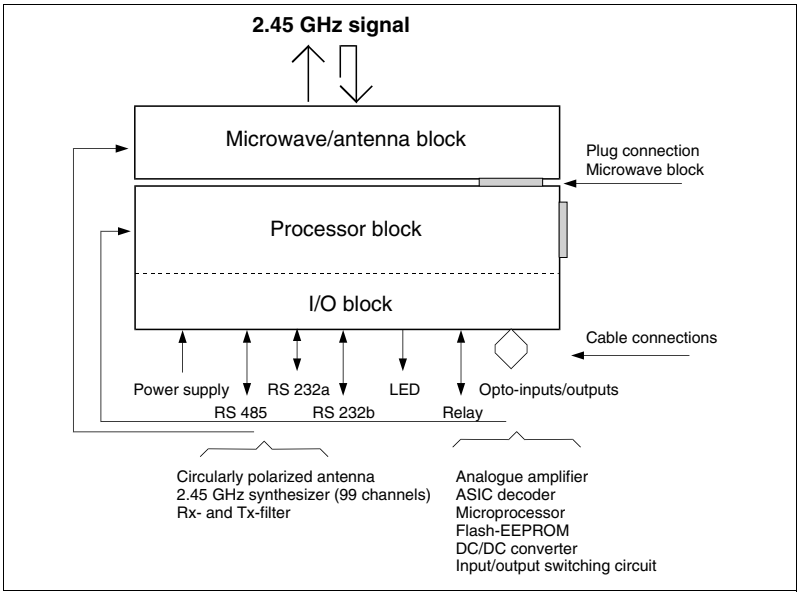


Bild 4.3: Communicator architecture

The communicator's control panel can be accessed by removing the front cover. The control panel has a 3-colour LED and an audible alarm to indicate the operating status. Both the LED and alarm are controlled by the user program.

The control panel also has two displays and three pushbuttons, two of which can be used to configure and test the communicator. Three jumpers are used for the internal battery and to define the serial interface. A monitoring contact indicates whether the front cover is open or closed.

The processor block with its various function groups, is located behind the patch antenna. The processor block's function groups include an analogue amplifier, an ASIC decoder, a 16-bit Hitachi microprocessor, memory, a DC/DC converter and I/O switches. The processor block is equipped with a real-time clock (RTC) and a "Watchdog" function for automatic reactivation in the event of malfunctions. The battery for the SRAM memory and the clock is charged as soon as power is supplied to the communicator. This allows the battery to maintain its voltage for up to two weeks after an interruption of DC power, which in turn allows the memory to retain all stored information.

Date of Issue 11.07.2002

4.4 The P+F-Talk protocol

The development of MTT-□□-S3 communicators resulted in the need for an expanded identification system protocol. Although the IDENT-I System P protocol could implement most MTT-□□-S3 communicator functions, an expanded protocol was necessary to operate MTT-□□-S3 extended functions.

4.5 Communicator models

Three new models of microwave communicators are now available: the MTT-S3, MTT-F52-S3 and MTT6000-F51-S3. The following lists the features of each:

MTT-S3

The standard communicator features:

- Maximum read distance of 4 m
- Standard housing with IP43 protection class
- 24 V DC
- Internal control panel with LED, display, configuration buttons and audible alarm
- Host interfaces: port A: RS 232,
  port B: Optional RS 232 or RS 485 2-wire

MTT-F52-S3

Same features as the standard communicator except:

- Special housing with IP65 protection class
- No housing cover monitoring

MTT6000-F51-S3

Same features as the standard communicator except:

- Maximum read distance is 6 m
- Larger housing with protection class IP56

Software

Note

Additional information concerning the Microwave Identification System IDENT-M System T components can be found in the Identification catalogue and the corresponding data sheets.

Date of Issue 11.07.2002

4.6 Code and data carriers

MTO-C1/MTO-C2 code carriers

The code carrier can be accurately read at a range of 6 m, even when multiple code carriers are located within the read zone.

Each code carrier is shipped with a default 8-digit decimal number and a 32-bit checksum for unique identification. This prevents confusing one carrier with another. A lithium cell ensures a long operating life regardless of the number of read procedures. When the cell is depleted, a bit is set in the status register of the code carrier. The communicator analyzes this bit during the next data transmission.

The MTO-C1 code carrier can be mounted using a clip, a card carrier, magnets, or adhesive strips. It can also be mounted with M3 screws. The MTO-C2 code carrier is mounted using 2 M4 screws.

The code carrier is vibration, water and corrosion proof. It is UV-stable and resists most chemicals.

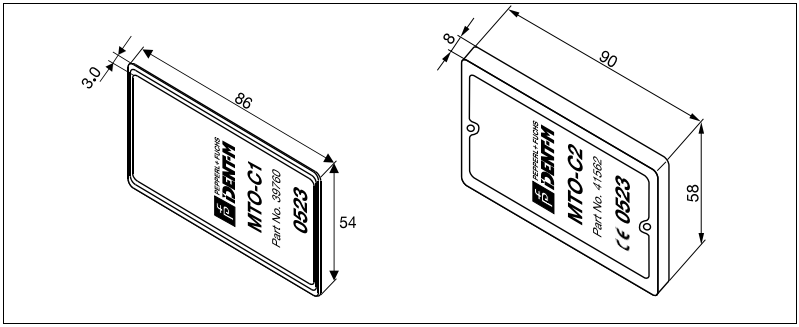


Bild 4.4: MTO-C1 and MTO-C2 code carriers

Date of Issue 11.07.2002

MTM-C1/MTM-C2 data carriers

The MTM-C1 and MTM-C2 are read/write data carriers that can be read at a range of 4 m and accurately written at a range of 0.5 m depending on the various settings.

Up to 574 bits of user data along with a 32 bit CRC CHK can be stored in the data carrier. In addition, a default 8-digit decimal number with checksum are stored in memory to prevent confusing individual data carriers with one another.

The microwaves are used to format and set the various operating modes. The same conditions apply to writing data as for reading data. The communicator should not be more than 0.5 m from the tag when writing data.

The life of the internal lithium cell depends on the mode in which the data carrier is operated. When the voltage drops at the end of the cell's life, a bit is set in the status register and transmitted to the communicator with each read process.

The data carrier is vibration, water and corrosion proof. It is UV-stable and resistant to most chemicals.

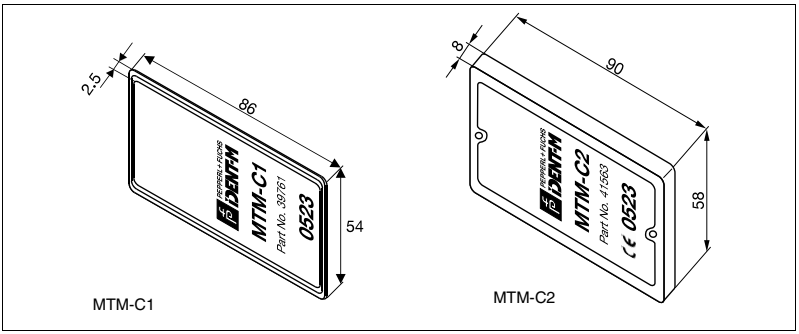


Bild 4.5: MTM-C1 and MTM-C2 data carriers.

Date of Issue 11.07.2002

4.7 Accessories

MTA-C1V1/MTA-C1V2 card holders

The MTA-C1V1 card holder is recommended for mounting IDENT-M System T code and data carriers to most objects. These are primarily used in the identification of persons. The holders are available with horizontal and vertical fasteners or may be worn using a cord.

The code or data carrier can be inserted into or removed from the card holder without tools. A specially shaped edge prevents the code or data carrier from falling out of the holder and being damaged.

The code or data carrier holders may also be mounted with screws or rivets.

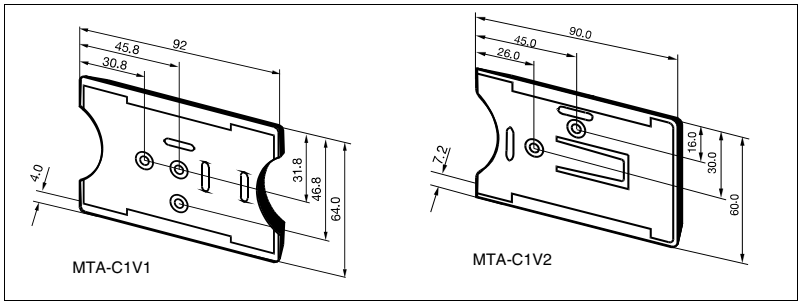


Bild 4.6: MTA-C1V1 and MTA-C1V2 card holders

4.8 Quickstart

4.9 Communication

In order to fully exploit IDENT-M System T, it is important to have a basic understanding of the communication that occurs between the communicators and the tags (code/data carriers).

Reading data

In IDENT-M System T, communicators emit a continuous microwave field unless the emitter is disabled using the **mi**<HeadN><MV-Ops><CHK><ETX> command, where <MV-Ops> = 0. As the tags (code/data carriers) enter this microwave field, the field is altered generating sideband frequencies. These sideband frequencies contain the data which the communicator reads. The type of data (1 s or 0 s) is based on the way in which the microwave field is altered.

When using multiple communicators, each communicator should operate on a different frequency or with a channel spacing of at least 2 channels. If two or more communicators must use the same frequency, then they should be installed at least 100 m apart to avoid interference or "cross-talk".

Date of Issue 11.07.2002

The tags in IDENT-M System T are "active" components in that they are continuously charged by an internal lithium cell, unlike the tags in other systems that are charged by a communicator's emitted field. IDENT-M System T tags can also be configured to alter the microwave field only at specified time intervals instead of continuously. This allows multiple tags to be read within a communicator's microwave field by giving the other tags a chance to "send" their data. The **tc**<HeadN><ReadTimeout>,<Speed><Interval><CHK><ETX> commands control the amount of "quiet time" compared to "send time" the tags will use.

The <Interval> can be set to r00, r04, r08 and r16 (for random intervals) or c00, c04, c08 and c16 (for constant intervals). These settings roughly correspond to the number of tags that can be read in a field at one time. If the <Interval> = r00 or c00, the tag sends data continuously. This mode does not allow multiple tags to be read, only the closest tag to the communicator is read. This setting is used to minimize the time it takes to read tags in faster applications. The higher the setting, the higher the number of tags that can be read and the longer it takes to read them and vice versa.

When setting the <ReadTimeout> command, it is important that it matches the general formatting of the tag. For example, assume that a tag has an interval setting of 16. This means that the tag's data is read and the tag becomes inactive for a period of 16 times as long as it took for the data to be read. If the tag carries enough data that the memory is full, it usually takes about 140 ms for the data to be read. The "quiet time" is therefore, just over 2 seconds. If the <ReadTimeout> is set to a value of under 2.5 seconds and a single read command is used, it is possible that the tag's data sent even after the communicator has stopped "reading". This would mean that the tag was not detected or properly read. The shorter the <ReadTimeout> parameter, the higher the likelihood this will occur. Two steps can be taken to resolve this issue:

1. Setting the <ReadTimeout> parameter to about 3 seconds
2. Using an auto read function, which will make a proper read possible since the <ReadTimeout> will not start until the initial tag is read.

Date of Issue 11.07.2002

Tag speed vs. read range

The <Speed> parameter sets the data transmission bit rate between the tag and the communicator. Depending on the communicator's setting, it can read either high read rate tags or low read rate tags. The read range is usually higher when using a low bitrate because data transmission occurs four times as often during the read process. This causes the sidebands to be more focussed and have a higher peak intensity. This higher peak allows the tag to be farther from the communicator while still being distinguishable from the background noise, thus giving the system a higher read range.

	Read time in [ms] at data transmission rate		Battery life [years]
Mini memory	High	Low	
MC0-H/L	50	130	6
MC4-H/L	100	360	6
MC8-H/L	170	660	10
MR4-H/L	170	660	9
Quarter memory			
QC0-H/L	70	240	6
QC4-H/L	180	700	9
QC8-H/L	350	-	10
QR4-H/L	350	1300	9
Full memory			
FC0-H/L	140	520	6
FC4-H/L	370	1400	6
FC8-H/L	750	-	10
FR4-H/L	750	-	10

Writing data

During the write process, the communicator's emitter is actually turned on and off to transmit data to the tag. It is important to remember that a field source that is rapidly turned on and off generates higher and lower frequency harmonics. These harmonics can interfere with the sidebands when tag data is received at neighboring channels. A channel spacing of at least 4 or 5 channels should be used between the read and write channels.

The read and write performance of the system depends significantly on the size of the tag memory. MTM series tags have an addressable data range that can accommodate 18_{dec} (= 12_{hex}) double words (one double word = 32 bits). The highest double word (located at address 17_{dec} = 11_{hex}) cannot be larger than $3FFF\ FFFF_{hex}$ (30 bits). Using the 14 bit mini-memory offers the highest performance while using 574 bit full memory results in the slowest read and write operations. P+F-Talk uses memory expansion and contraction to use the best memory model possible. The operator does not have to specify the memory model because this is done automatically.

Date of Issue 11.07.2002

Due to the unique method of transmitting data between a tag and the communicator, data is stored in a shift register that is constantly "rotated". The amount of rotation depends on how much of the shift register is used, which also determines the rate of data transmission. The tag's design allows the use of three distinct shift register sizes. The shift register sizes that can be used are 14 bits, 154 bits and 574 bits. In each case 32 bits of checksum data are added by the system, which is inaccessible to the operator. Any of the three shift register sizes can be used when writing only one byte of data to the tag at address 0. P+F-Talk was designed to always use memory as efficiently as possible to store data. For example, assume that the tag contains data, which uses the first and last byte on the tag and all other bits are 0. In order to store this information, the largest memory model with 574 bits is required. The information in the last byte is then overwritten with 0 s. This is followed by contraction. It's not necessary to actually store more than the first byte during contraction, since all "unused" shift register bits are defined to contain 0 bits. The tag is reformatted so that it uses only 14 bits of shift register memory when the last byte is written to contain 0 bits, increasing performance.

The opposite occurs when any bit in a memory location over 14 bits is a 1. P+F-Talk reformats the tag to the appropriate memory usage. Unfortunately, the boundaries where shift register memory is switched do not coincide with the double-word structure used when storing data. If a tag must be formatted to use only the first 14 bits (because of read speed for instance), several conditions must first be met:

1. Only the dual word at address 0 can be used to store value 1 bits; all other words must contain 0000_{hex}.
2. 16383 is the largest hex number that can be stored in 14 bits of memory, which corresponds to $3FFF_{hex}$.
3. The following complete data string can be used to write numbers between 0000_{hex} and $3FFF_{hex}$ to the tag:

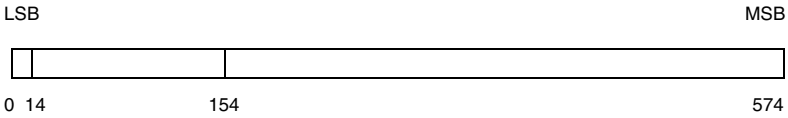
   0000 $3FFF_{hex}$ followed by $\{0000\ \ 0000\}_{17\ times}$. This defines a dual word in hexadecimal format. New data only need to be written to the first dual word when a tag is known to only use the first 14 bits. Once again, data cannot be larger than 0000 $3FFF_{hex}$, otherwise expansion takes place.

Date of Issue 11.07.2002

The following rules determine which memory model is used:

- An "empty" tag is assumed to be "filled" with 0 bit values.
- The next higher memory model is used only when a 1 bit value exceeds the present memory model limit.
- Contraction occurs when a particular bit is set low and all other bits in that memory model segment are low.

The following is a model of the various levels of memory:



Examples

Assume that the start address on the tag is zero for the following examples (<WordAdr> = 00_{hex}). All other memory locations are zero and all data in the following examples are preceded by zeros.

- Data between 0_{hex} and $3FFF_{hex}$ will be stored in the first 14 bits. Bit 14 and bit 15 are zero and will not be stored in the higher memory.
- Data between 0_{hex} and 3FF FFFF ($FFFF\ FFFF_{hex}$)$_{4\ times}$ will be stored in the first 154 bits. Bits 154 through 159 are zero and will not be stored in higher memory.
- Data between 0_{hex} and 3FFF FFFF ($FFFF\ FFFF_{hex}$)$_{17\ times}$ will be stored in full memory. Larger values cannot be stored.

Date of Issue 11.07.2002

4.10 Read/write ranges

The read range is dependent on the following settings for the alignment of code or data carriers and communicators:

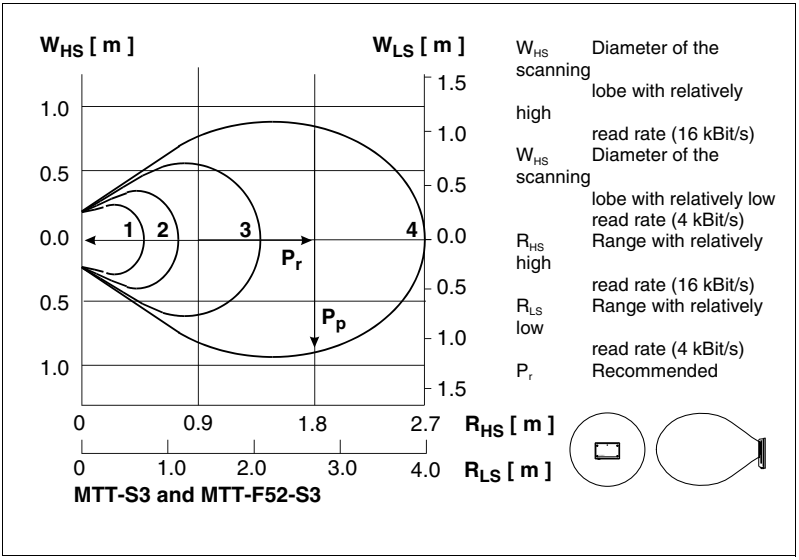
- The selected read range value
- Adjusted read rate of code/data carriers

The following read-range settings are possible:

read range	range factor
4	100 %
3	50 %
2	25 %
1	12 %

Write operations to a data carrier are independent of read range and read speed settings. The maximum write range for all communicators is 0.5 m.

The following two illustrations show the read ranges of the communicators:



MTT-S3 and MTT-F52-S3

Bild 4.7: Read ranges of the MTT-S3 and the MTT-F52-S3 (approximate values)

Date of Issue 11.07.2002

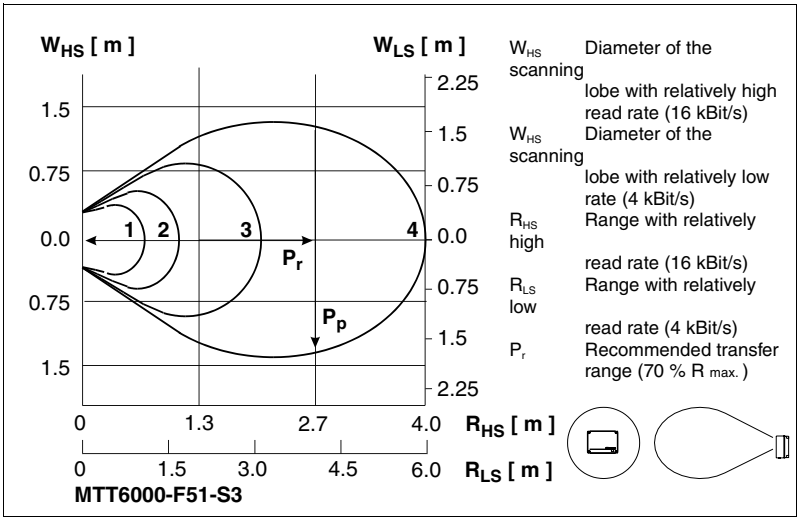


Bild 4.8: Read ranges of the MTT6000-F51-S3

Date of Issue 11.07.2002

Date of Issue 11.07.2002

5 Installation

5.1 Storage and transportation

The communicator should be well packed for transportation and storage, so that protection is provided against shock and dampness. Optimum protection is afforded by the original packaging. The device must always be operated within the permissible ambient conditions (see section 10).

5.2 Unpacking

Inspect the contents for damage. In the event of damage, the postal service or goods transport service should be informed and the supplier notified.

Inspect the contents of the delivery package against your order and the delivery documents:

- Quantity supplied
- Device type and version in accordance with the type plate
- Accessories
- Manual/manuals

Preserve the original packaging in case the device has to be stored or despatched at a later date.

Please address any queries to Pepperl+Fuchs.

5.3 Installation of the devices

5.3.1 Site selection

Observe the following when selecting the installation site:

- Install the communicator on a flat surface. Use an adjustable mounting plate if the communicator must be aligned or readjusted from time to time. This is particularly important if metal surfaces are located within the read/write zone near the code or data carriers. (Pepperl+Fuchs suggest using the RAM mounting system. Please contact your Pepperl+Fuchs representatives for additional information.)
- Align the surfaces of the code or data carriers with the communicator's emitter to allow optimum communication.
- Avoid maximum distance between communicators and tag when the code or data carriers travel at a high rate of speed through the detection zone.
- The communicators should be installed with the cable connectors pointing downward for easy accessability and proper connection.
- The MTT-F52-S3 must employ protection class IP65 when installed outdoors. A protective cover should also be used as added protection against ice, rain, hail etc.

Date of Issue 11.07.2002

Example:

Code carriers can be installed behind the windshield of vehicles for vehicle identification. The windshield does not interfere with the communicator's ability to read or write.

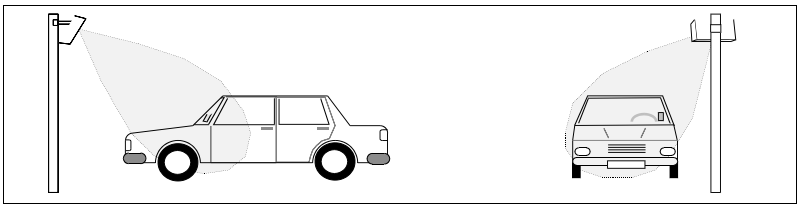


Bild 5.1: Vehicle identification

The MTT-□□-S3 communicator should be installed at a downward angle at a height of about 2 m for the best read results.

5.3.2 Communicator installation

Remove the communicator's housing cover by loosening the 4 or 6 screws on the front. The communicator can be mounted using 4 M4 screws. The following illustrations show the locations of the mounting holes in each of the communicator models.

Model MTT-S3 communicator

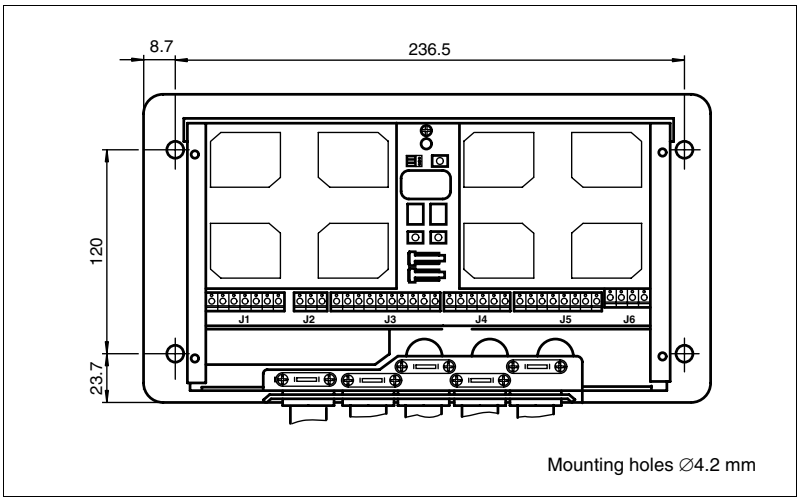


Bild 5.2: MTT-S3 mounting hole locations

It is possible on the MTT-S3 to connect the cable through the rear of the housing for certain safety applications where the removal of the housing cover is monitored by a microswitch and the cable connections should not be accessible from the exterior.

Date of Issue 11.07.2002

Attention

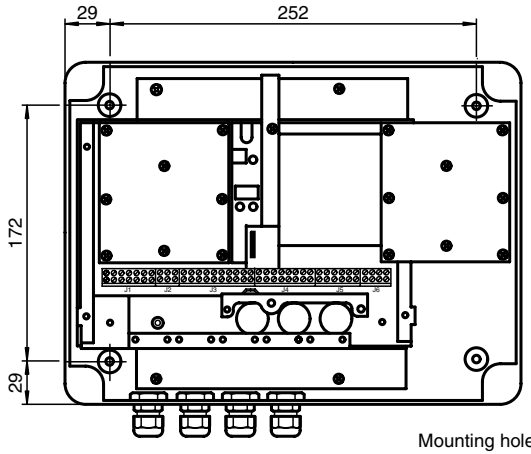
Please note that the IP43 protection class can no longer be guaranteed for the communicator in the case mentioned above.

Model MTT-F52-S3 communicator

Mounting holes ∅4.2 mm

Bild 5.3: MTT-F52-S3 mounting hole locations

Model MTT6000-F51-S3 communicator



Mounting holes ∅4.2 mm

Bild 5.4: MTT6000-F51-S3 mounting hole locations

Date of Issue 11.07.2002

5.4 Connection

Warning

Only qualified technicians are authorized to service or install system components while the system is powered.

Ensure that the correct voltage is applied in accordance with the device's label.

A supply isolator must be installed close to the MTT-□□-S3 communicator and labeled as such.

All power sources should be disconnected before making electrical connections and servicing the communicator.

Wait at least 1 minute after disconnecting power before removing a circuit board otherwise the communicator may be damaged.

5.4.1 Device connection

Connect and configure the communicator by removing the housing cover and accessing its removable terminal blocks and control panel.

The following illustration shows the location of the terminal blocks and controls:

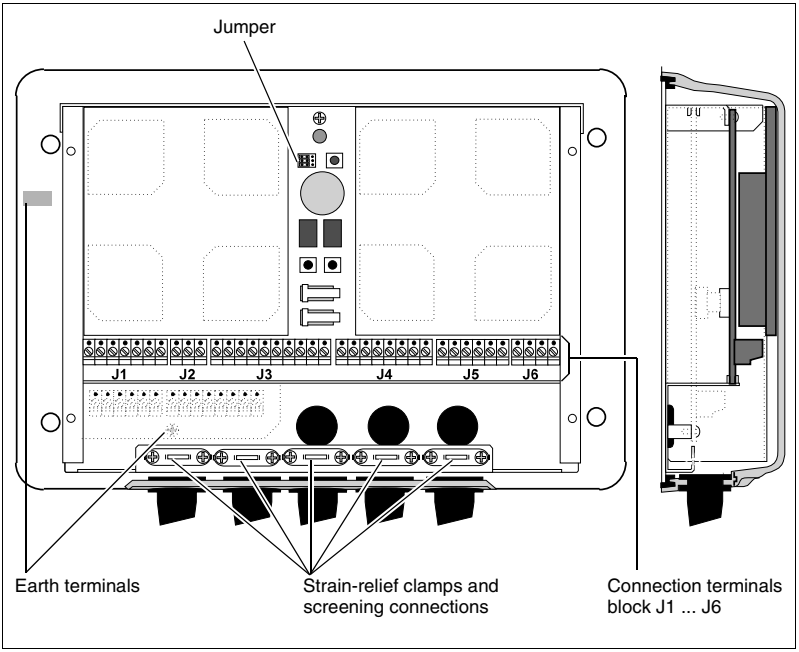


Bild 5.5: MTT-S3 terminal locations

Date of Issue 11.07.2002

Only use screened cables for all device connections. The communicator and cable can be effectively grounded by tightening down the strain-relief clamp over the cable's exposed wire mesh or foil screening.

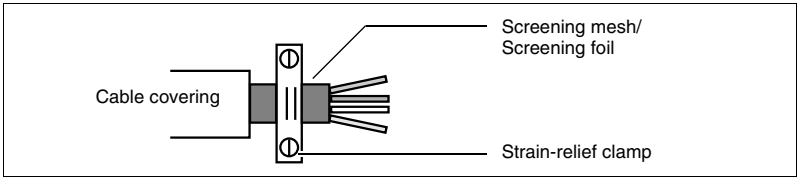


Bild 5.6: Proper grounding using strain-relief clamps

The cable's leads can then be inserted into the individual screw terminals on the removable terminal blocks (J1-J6) completing the communicator's connection.

Attention

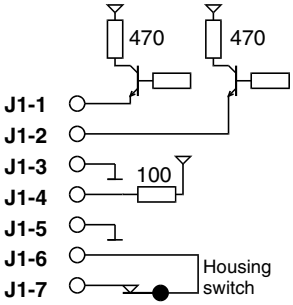
The supply voltage must be applied such that polarities are never reversed. To alleviate any concerns a protection diode can be used.

Date of Issue 11.07.2002

5.4.2 Terminal assignment

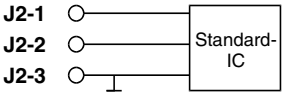
Terminal block J1:

Terminals	Signal	Meaning
J1-1	LED1	LED output 1
J1-2	LED2	LED output 2
J1-3	GndLED	ground LED output
J1-4		Not used
J1-5		
J1-6	Tamp a	Housing switch
J1-7	Tamp b	



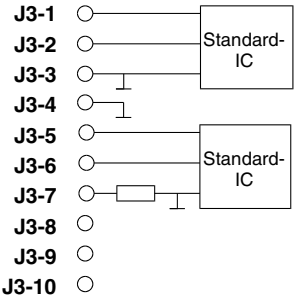
Terminal block J2:

Terminals	Signal	Meaning
J2-1	Tx 232a	RS 232 interface A
J2-2	Rx 232a	
J2-3	Gnd 232a	



Terminal block J3:

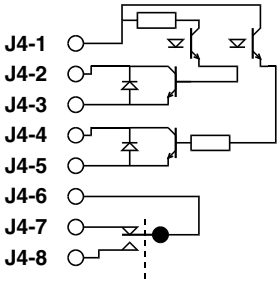
Terminals	Signal	Meaning	
J3-1	Tx 232b	RS 232 interface B	
J3-2	Rx 232b		
J3-3	Gnd 232b		
J3-4	CGnd	common ground	
J3-5	Tx–/Rx– 485	RS 485 2 wire	B
J3-6	Tx+/Rx+ 485		A
J3-7	Gnd 485	RS 485 Ground	
J3-8		Not used	
J3-9			
J3-10			



Date of Issue 11.07.2002

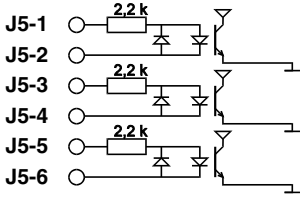
Terminal block J4:

Terminals	Signal	Meaning
J4-1	Outspl1	Voltage outputs
J4-2	Out 1c	Output 1, collector
J4-3	Out 1e	Output 1, emitter
J4-4	Out 2c	Output 2, collector
J4-5	Out 2e	Output 2, emitter
J4-6	R1c	Relay output
J4-7	R1b	
J4-8	R1m	



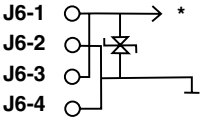
Terminal block J5:

Terminals	Signal	Meaning
J5-1	In 1a	Optical coupling input 1
J5-2	In 1c	
J5-3	In 2a	Optical coupling input 2
J5-4	In 2c	
J5-5	In 3a	Optical coupling input 3
J5-6	In 3c	



Terminal block J6:

Terminals	Signal	Meaning
J6-1	Spl 1	Supply voltage +
J6-2	Rtnspl 1	Supply voltage -
J6-3	Spl 2	Supply voltage +
J6-4	Rtnspl 2	Supply voltage -



* See preevious page for additional information concerning the connecting power to the system.

Date of Issue 11.07.2002

5.4.3 Connection diagrams

RS 232 interface A/B

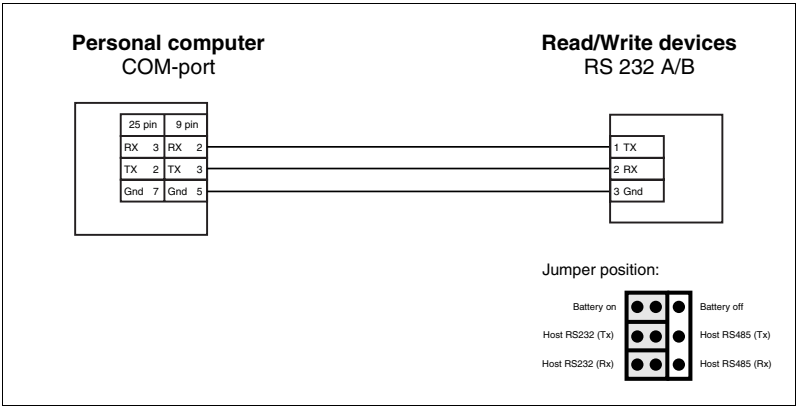


Bild 5.7: Connection to PC/host via one of the RS 232 interfaces

RS 485 interface

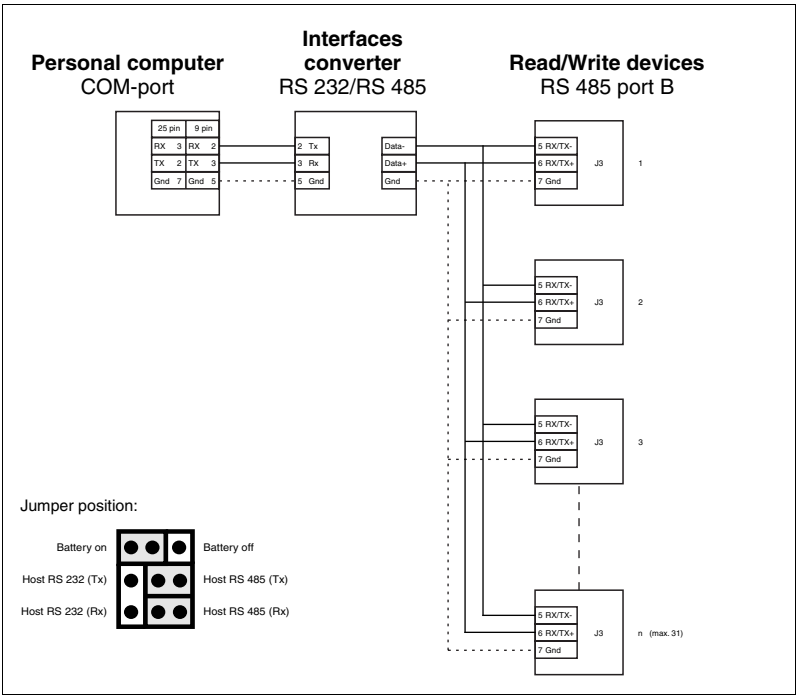


Bild 5.8: Multipoint connection to PC/host via the RS 485 interface

Date of Issue 11.07.2002

MTT6000-F51-S3 inputs/outputs

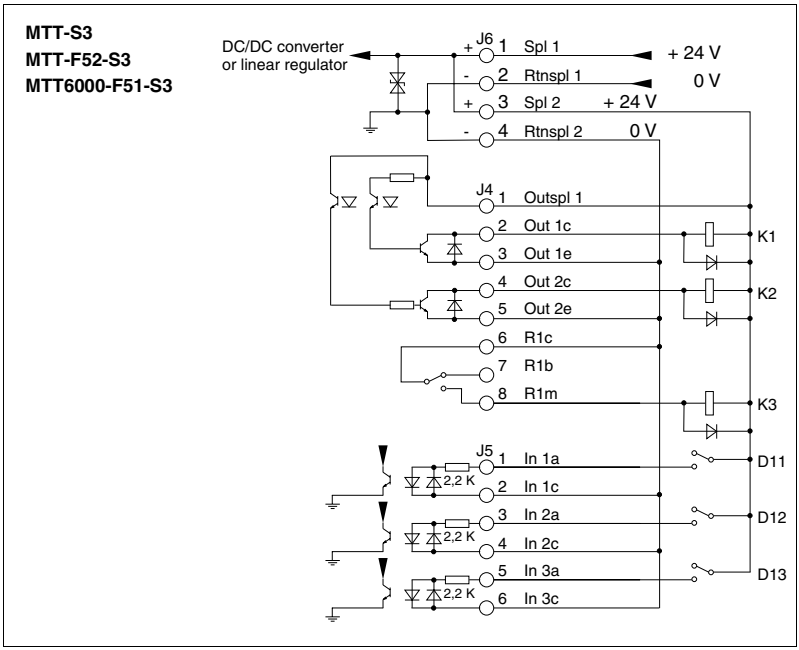


Bild 5.9: Wiring of the inputs and outputs

Supply voltage

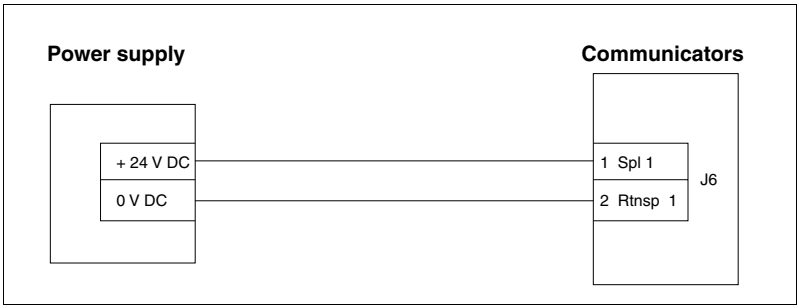


Bild 5.10: Connection of the supply voltage

Date of Issue 11.07.2002

5.4.4 Connection cables

Only cables with the following specifications should be used when connecting the communicator:

Power supply	AWG 0.5 mm^2 , 2-wire mains voltage 300 V max. temperature +80 °C recommended outside diameter > 5 mm max. cable length 100 m
Inputs/Outputs	AWG 0.5 mm^2
RS 232	cable in accordance with RS 232 specification EIA RS 232C, e. g. Belden 9184 or Belden 9502
RS 485	cable in accordance with RS 485 specification EIA RS 485, e. g. Belden 9841

5.4.5 Hardware settings

Jumpers:

There are 3 jumpers located on the main circuit board (see figure 5.5) that are used for the following:

- Buffer battery for internal RAM: on/off
- Switchover host-interface port B Tx: RS 232/RS 485
- Switchover host-interface port B Rx: RS 232/RS 485

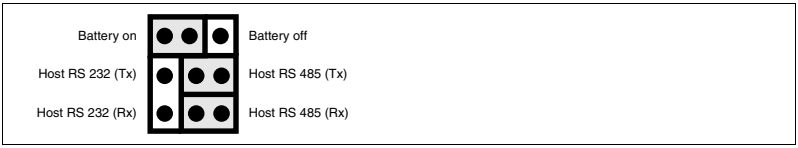


Bild 5.11: Jumper settings

Date of Issue 11.07.2002

5.4.6 EMC, screening and grounding

The screening of the cables prevents electromagnetic interference. One side of the screening is combined with a low-impedance connection to ground, while the other side is capacitively coupled. The MTT-S3, MTT-F52-S3 and MTT6000-F51-S3 microwave communicators are equipped with two ground terminals (see figure 5.5).

When installing, connect these two terminals to ground. This is best carried out using large metallic objects with a galvanic ground connection, e. g. switching cabinets, high-bay storage posts, etc.

When configuring a cable with dual screening (e. g. wire mesh and metal foil), a low-impedance connection must be made between the two forms of screening at the cable ends.

The supply cables radiate a large amount of electromagnetic interference for example, the activation current of a motor. For this reason, avoid installing the supply cables in parallel with the data/signal cables or within the same cable duct.

5.5 Disassembly, repackaging and disposal

Repackaging

The communicator must be protected against humidity and shock when repacking it for later use. Re-use the original packaging for the best protection.

Disposal

Note

Discarded electronic devices can be hazardous. Please observe local regulations when disposing of the communicator.

The MTT-S3, MTT-F52-S3 and MTT6000-F51-S3 microwave communicators contain a rechargeable internal battery (Panasonic UL 1220 or other), which must be removed and separately disposed of before discarding the communicator.

The backup battery is located on the control panel's circuit board, between the two pushbuttons, the housing switches and beneath the screening plates.

The battery can be removed for disposal by bending the battery's contact/retaining latch upwards with a screw driver for example, and prying the battery out.

Date of Issue 11.07.2002

Date of Issue 11.07.2002

6 Operation

6.1 Device activation

Warning

Ensure prior to system activation that there is no danger to the system through unmonitored, controlled processes.

Attention

Verify all connections and hardware settings before placing the system into operation.

Become familiar with the configuration of the communicator (section 7 and 8 of this manual) before operating the system.

Note

Pepperl+Fuchs first recommends testing the identification system under offline, test conditions when using custom application software on the communicator.

6.2 Check device installation

Please verify the following before operating the device:

- Ensure that all electrical connections and jumper settings are correct.
- Make certain that the area between the code/data carrier and the communicator is free of metal objects.
- Align the code/data carrier(s) with the communicator as accurately as possible. This is the only way to ensure the highest communication range possible.
- Avoid using the maximum communication range possible, to prevent communication errors.
- Ensure that the communicator cannot be affected by extreme temperatures and electromagnetic fields at the installation site.

Date of Issue 11.07.2002

6.3 Communication test

PC communication

Follow the steps in the Quick Start section (section 4.8) to configure the system and verify its operation.

Check the communication between the PC and the communicator using the RS 232 interface to ensure proper function as described in the calibration-software manual.

Note

Information on resolving communication errors can be found in section 9, "Fault diagnostics".

6.4 Conditions affecting operation

Microwave communication may be affected by certain conditions:

- Problems may arise when metal objects or surfaces are located within the microwave between code/data carriers and the communicator.
- The maximum read range can be expanded or the microwave can be narrowed as a result of the reflection of microwave radiation.
- If the code/data carriers are to be read at very close range, the maximum read range or reception sensitivity can be reduced to prevent unintentional reading of more distant code/data carriers.

A series of trials must be used in these cases to determine such things as the alignment and the best site for mounting the MTT, as well as the ability of the code/data carriers to recognize speed and motion.

Date of Issue 11.07.2002

7 Configuration

7.1 Device configuration using the internal control panel

The MTT communicators each have an internal control panel that can be used to configure them even in the absence of a PC or host. The control panel is accessed by removing the communicator's cover and is located between the two microwave antenna.

A parameter can be selected by repeatedly pressing the left pushbutton above the two housing switches until the desired parameter appears in the two 7-segment displays. The right pushbutton can then be used to change the parameter's values in the same way. The new setting is locked-in and activated by pushing the left button one more time. A single beep indicates that the settings have been accepted.

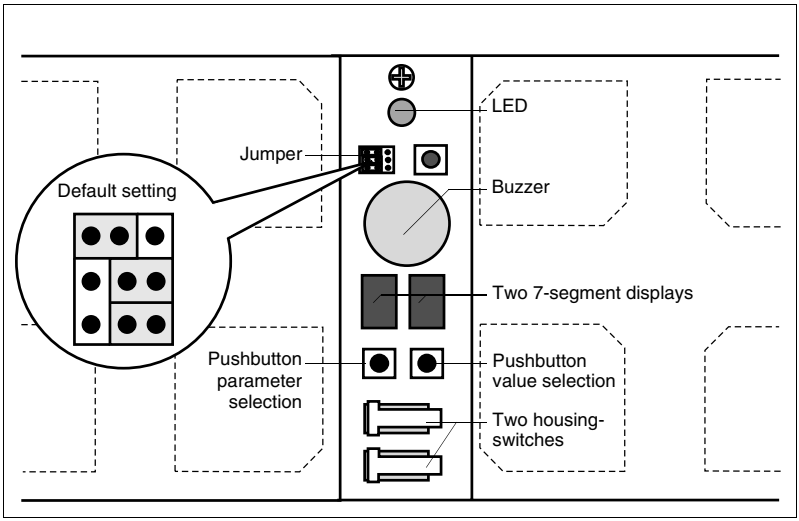


Bild 7.1: Control panel's location

Control panel settings are stored in permanent memory and are not lost as a result of disconnecting the operating voltage, even for longer periods of time.

Note

Date of Issue 11.07.2002

Restoring default values

Attention

Restoring the communicator to its default values deletes all of the adjusted settings.

There are two options for restoring the communicator's default settings:

1. Issue the **rd** (Reset default) command using the serial interface, followed by issuing the **rS** (Reset) command.
2. Select **rd** by pushing the parameter selection button. Then push the value selection button until "do" appears. Push the parameter selection button once more to initiate the Reset.

The Reset is necessary to update those operating parameters that are "Static" (listed in the following tables).

7.2 Configuration settings

The following sections list all parameters and their respective values in tabular form.

Note

Each parameter's default value is indicated in the table by bold-face type.

7.2.1 Display parameter and value tables

Parameter	Function	Value	Behaviour	Explanation
Ad	Select communicator address	00	Dynamic	Multidrop off
		01-1F		Communicator address
it	Serial interface timeout	**00**	Static (needs Reset)	Disables serial interface timeout
		01-99/99.		Timeout in 100 ms intervals. Values larger than 99 can not be selected via push-button (use serial command) but are indicated by the "period". Pushing when 99 is displayed selects 00!
pb	Serial port B connection	23	Static (needs Reset)	RS 232 (ib can be up to 19200 bps)
		48		RS 485 (ib can be up to 38400 bps)
ib	Serial interface baud rate	12	Static (needs Reset)	1200 bps
		24		2400 bps
		48		4800 bps
		96		9600 bps
		19		19200 bps
		38		38400 bps, available only if pb=48

Date of Issue 11.07.2002

Parameter	Function	Value	Behaviour	Explanation
cF	Configure microwave frequency	01-99 default=**50**	Dynamic	Frequency channel 01-99
cr	Configure range	1, 2, 3, **4**	Dynamic	Range
tS	Tag speed	**HI**	Dynamic	High data speed
		Lo		Low data speed
rt	Read timeout	01-99/99. default=**30**	Dynamic	Read timeout in 100 ms intervals. Values larger than 99 can not be selected via push-buttons (use serial commands) but are indicated by the "period". Pushing when 99 is displayed selects 01!
tI	Tag interval	00	Dynamic	Tags are formatted without a time interval between individual data frames.
		r4		Random interval 4
		r8		Random interval 8
		r6		Random interval 16
		c4		Constant interval 4
		c8		Constant interval 8
		c6		Constant interval 16
cS	Configuration store	**OF**	Dynamic	Automatic execution turned off
		ON		The on display indicates that a stored configuration is being used. The user can switch configuration store off using the pushbuttons.
ni	Microwave interface	1	Dynamic	Enables reading of tags that are formatted to low read rates. Multiple tags can be read within one "Read timeout" period.
		2		Enables reading of tags that are formatted to high read rates. Multiple tags can be read within one "Read timeout" period.
		3		Enables reading of tags that are formatted to low read rates. Only one tags can be read within one "Read timeout" period.
		4		Enables reading of tags that are formatted to high read rates. Only one tags can be read within one "Read timeout" period.
		0		Disables reading of tags.
cd	Configure doppler radar	**00**	Dynamic	00 turns off the doppler radar.
		01-30		Specifies the sensitivity of the doppler radar with 01 being the least and 30 being the most sensitive settings.

Date of Issue 11.07.2002

Parameter	Function	Value	Behaviour	Explanation
sh	Setup help	00-13 default=**00**	Dynamic	00 deactivates setup help mode, 01-13 selects a setup help function (see page 68)
St	Single configuration tag write	no	Dynamic	Do not perform the operation.
		do		Attempt to write the current configuration to a tag. Short beep and green main LED (1 second) indicate a successful operation. If unsuccessful the main LED turns red for 1 second.
rS	Reset	**no**	Dynamic	Do not perform Reset.
		do		Perform Reset, flash main LED green 5 times if successful. After the operation the display is turned off and starts at **Ad**.
rd	Reset default	**no**	Dynamic	Do not perform Reset to default.
		do		Resets all configuration values to their default settings. Settings that are "Static" become active after the next Reset.
Lc	List configuration	**no**	Dynamic	Do not list configuration.
		do		Lists the current configuration of the communicator. The configuration is sent to RS 232 port A using a default baud rate of 9600. This function is similar to the **lc** command issued via the serial interface.
bc	Bypass configuration	**OF**	Dynamic	The communicator attempts to read a setup tag for the first 10 seconds after the power-up or a Reset (**rs**).
		On		The communicator does not scan for setup tags.

Note

*The operator will note that some of the command parameters do not match the characters being displayed (e. g. the microwave interface on/ off command = **mi** but is displayed as "ni"). This discrepancy is due to the unavailability of additional characters (some characters had to be reused).*

Date of Issue 11.07.2002

7.2.2 Configuration using setup tag

Most operation relevant parameters that can be set with command can also be set via configuration tag. The format of the configuration tag is as follows. Commas, separating parameters, are part of the string and need to be on the configuration tag. Angular brackets ([and]) are not part of the string.

$$$$**ad**[nn]ci[to,br]cm[fq,r]tc[rto,s,int]sh[nn]cd[vvvv]mi[m]cs[CS]

				# of ASCII Characters
ad[nn]	Address of MTT□□-S3	[nn]=00	Multidrop mode off	4
		[nn]=01 to 1F$_{hex}$	Multidrop mode on, MTT-□□-S3 address = nn$_{hex}$	
ci[to,br]	Configure interface	to	is the timeout as defined previously (000 to 999) in 100 ms	11
		br	is the baud rate defined previously (five digits with leading zeros if necessary)	
cm[fq,r]	Configure microwave interface	fq=01 to 99	Microwave frequency channel	6
		r=1 to 4		
tc[rto,s,int]	Configure tag communication	rto=001 to 999	is the read timeout as specified previously	11
		s=1, 2	sets microwave communication speed	
		int=c00, c04, c08, c16, r04, r08, r16	is the backscatter interval between two data frames. c indicates the tag sends data at constant timer intervals.	
sh[nn]	Setup help mode	nn=00	Normal operation	4
		nn=01 to 13	Activate help mode (note: nn=12 can not be selected)	
cd[vv]	Doppler radar on/off	vv=00	Doppler radar deactivated	6
		01 to 30	Doppler threshold	

Date of Issue 11.07.2002

mi[m]	Microwave interface	m=0	Disables reading of tags	4
		m=1	Enables reading of tags that are formatted to low read rate. Multiple tags can be read within one "Read timeout" period.	
		m=2	Enables reading of tags that are formatted to high read rate. Multiple tags can be read within one "Read timeout" period.	
		m=3	Enables reading of tags that are formatted to low read rate. Only one tags can be read within one "Read timeout" period.	
		m=4	Enables reading of tags that are formatted to high read rate. Only one tags can be read within one "Read timeout" period.	
cs[CS]	Configuration string	No CS on setup tag turns off configuration store		variable
		CS=BR0000	Sets up a buffered read from 0000 reading 18dec (=12hex) double words	

During power up, the MTT-S3 attempts to read a setup tag for 10 seconds if *bypass configuration* is off. During this time the main LED is on solid amber. Once a tag enters the read zone it is read and the MTT-S3 evaluates the validity of the full string and confirms it by flashing the main LED green five times. Additionally, the beeper beeps one time. Five red flashes indicate an invalid string. If the read tag appears to be a setup tag (i. e. the tag data starts with $$$$ but the format is not correct the beeper beeps three times. If a "normal" tag was read, only the red LED flashes and no beep is generated. After this start-up procedure the communicator behaves as defined by the setup parameters and the modification as defined by the setup help modes.

In all cases the <CHK><ETX> that must beaded to a command string can be replaced by a #<CR>. Since no checksum is used in this case it must not be used in control applications.

Date of Issue 11.07.2002

8 Communication with a host or PC

As stated earlier in this manual, the MTT-□□-S3 communicators are the heart of the IDENT-M System T identification system that establish a link between the tags (code/data carriers) and a higher level host or PC.

8.1 Multidrop/Point-to-point communication

An identification system using multiple communicators is said to be using multidrop communication. In the multidrop mode, data is retrieved using the **gd** (get data) or **gb** (get buffer) commands.

A system with only one communicator is using point-to-point communication where the address setting is 00. For this reason, the address specification <HeadN> is omitted from all the commands in the point-to-point mode. The **gd** and **gb** commands are not available in the point-to-point mode.

The commands for the multidrop mode and the point-to-point mode of communication are identical with the exception of the differences mentioned above. The following sections list all the commands as they are used in the multidrop mode. The commands as they appear in the point-to-point mode, are not listed to avoid duplicating information and for reasons of brevity.

In all cases the <CHK><ETX> that must beaded to a command string can be replaced by a #<CR>. Since no checksum is used in this case it must not be used in control applications.

The following are examples of the command structures.

True for all system commands:

Multidrop

Command: **ad**<HeadN><Ad-Parameter><CHK><ETX>
Response: <Status><HeadN><CHK><ETX>

Point-to-point

Command: **ad**<Ad-Parameter><CHK><ETX>
Response: <Status><CHK><ETX>

True for all read commands:

Multidrop

Command: **sr**<HeadN><WordAdr><NWord><CHK><ETX>
Response: <Status><HeadN><CHK><ETX>

Point-to-point

Command: **sr**<WordAdr><NWord><CHK><ETX>
Response: <Status><CHK><ETX>

Note

*The operator will note that some of the command parameters do not match the characters being displayed (e. g. the Microwave interface on/off command = **mi** but is displayed as "ni"). This discrepancy is due to the unavailability of additional characters (some characters had to be reused.*

Date of Issue 11.07.2002

8.2 Protocol definition

8.2.1 Command overview

System commands	Abbreviation	Page
Version	**ve**	page 46
Address selection	**ad**	page 46
Quit	**qu**	page 46
Reset	**rs**	page 47
Microwave interface on/off	**mi**	page 47
Change tag	**ct**	page 48
Configure serial interface	**ci**	page 48
Configure microwave interface	**cm**	page 49
Configure tag communication	**tc**	page 49
Reset default	**rd**	page 49
Setup help mode	**sh**	page 50
Configure doppler interface	**cd**	page 50
Get data (multidrop protocol only)	**gd**	page 51
Get buffer (multidrop protocol only)	**gb**	page 52
List configuration	**lc**	page 52
Define master bit	**db**	page 54
Get master bit	**gm**	page 55
Master status	**ms**	page 56

Date of Issue 11.07.2002

Read commands	Abbreviation	Page
Single read	**sr**	page 57
Auto read	**ar**	page 58
Buffered read	**br**	page 58
Enhanced read	**er**	page 59
Single fixed read	**sf**	page 59
Auto fixed read	**af**	page 60
Buffered fixed read	**bf**	page 60
Enhanced fixed read	**ef**	page 61

Write commands	Abbreviation	Page
Single write	**sw**	page 62
Auto write	**aw**	page 63
Format tag	**ft**	page 63
Single configuration tag write	**cw**	page 63

Input/Output commands	Abbreviation	Page
Define output	**do**	page 64
Get input/output	**gi**	page 64
Start/Stop buzzer	**bz**	page 64
Beep	**be**	page 64
Main LED on/off	**ld**	page 65

Automatic command execution	Abbreviation	Page
Configuration store	**cs**	page 66

Date of Issue 11.07.2002

8.2.2 System commands

Version

Command: **ve**<HeadN><CHK><ETX>

Response: <Status><HeadN> (C) P+F IDENT-M <CR><LF>
MTT-□□-S3 <CR><LF>
#<PartNumber> <CR><LF>
<SW-Number> <CR><LF>
<Date> <CHK><ETX>

Display: "Not available"

This command requests information on the version of the MTT-□□-S3 and is model specific.

Address selection

Command: **ad**<HeadN><Ad-Parameter><CHK><ETX>

Response: <Status><HeadN><CHK><ETX>

Display: "Ad"

This command enables the user to switch from the addressable, multidrop protocol to the point-to-point protocol. There are two versions of this command.<Ad-Parameter> specifies the multidrop address on the MTT-□□-S3 (range 00_{hex} to $1F_{hex}$) and <Ad-Parameter> = 00 turns off the multidrop protocol. If the MTT-□□-S3 is currently in multidrop mode, the <HeadN> parameter must be specified to switch multidrop off or change the address of the communicator. If multidrop is currently off, then the <HeadN> parameter is not used. The change takes effect immediately. This parameter is part of the configuration tag "default" = 00.

Quit

Command: **qu**<HeadN><CHK><ETX>

Response: <Status><HeadN><CHK><ETX>

Display: "Not available"

This command stops the execution of an active auto, buffered, or enhanced command.

Date of Issue 11.07.2002

Reset

Command:	**rs**<HeadN><CHK><ETX>
Response:	<Status><HeadN><CHK><ETX>
Display:	"rS"

This command resets the communicator. It forces the communicator to stop its current operation, performs an internal test and restarts the application. If "Configuration Bypass" = no, the communicator starts scanning for setup tags. After a successful restart the status will be 2ASCII. If "Configuration Bypass" = on, the communicator will not scan for setup tags and the application won't check the status of switch S3 (right bush button) resulting in a fast reset-time. This command is **not** the same as the "Reset default" command.

Microwave interface on/off

Command:	**mi**<HeadN><MV-Ops><CHK><ETX>
Response:	<Status><HeadN><CHK><ETX>
Display:	"ni"

This command turns on the microwave interface and determines if multiple tags can be read during one "Read timeout" period or not.

<MV-Ops> = 0 turns the microwave interface off and disable read and writing of tags.

<MV-Ops> = 1enables reading of tags that are formatted to low read rate. Multiple tags can be read within one "Read timeout" period. The command remains active and the Communicator scans for tags for the "Read timeout" period.

<MV-Ops> = 2 (default) enables reading of tags that are formatted to high read rate. Multiple tags can be read within one "Read timeout" period. The command remains active and the Communicator scans for tags for the "Read timeout" period.

<MV-Ops> = 3 enables reading of tags that are formatted to low read rate. Only one tag can be read within one "Read timeout" period. As soon as one tag has been found the command stops scanning for tags.

<MV-Ops> = 4 enables reading of tags that are formatted to high read rate. Only one tag can be read within one "Read timeout" period. As soon as one tag has been found the command stops scanning for tags.

If the microwave interface is off, the MTT-□□-S3 does not emit a microwave field and tags can not be read or written to. The microwave interface should not be turned on frequently in most applications because this produces field bursts that extend to higher channels, which may interfere with the ability of other communicators to read tags.

Date of Issue 11.07.2002

Change tag

Command:	**ct**<TT><CHK><ETX>
Response:	<Status><HeadN><CHK><ETX>
Display:	"Not available"

This command has no real function since the MTT-□□-S3 can read all tags currently offered for this system (changing the mode is unnecessary). It was retained to keep the function of the communicator as similar to IDENT-I System P as possible. The <TT> Parameter can be any number between 00 ... 99 and <Status> in the response is always "0".

Configure serial interface

Command:	**ci**<HeadN><Timeout>,<Baud><CHK><ETX>
Response:	<Status><HeadN><CHK><ETX>
Display:	"it", "pb" or "ib"

<Timeout> specifies the time limit (xxx in 100 ms) after which the communicator will no longer wait for characters to compose a command. In a non-multidrop mode, the interface issues an error (<Status> = 4) after the timeout and deletes all stored characters of the incomplete command. The next character received after this process will be interpreted as the beginning of a new command. <Timeout> ranges from 000 to 499 and the default is 000. <Timeout> = 000 disables the timeout function.

Note

<Baud> (xxxxx) sets the baud rate of the serial interface and must be entered as 5 characters!

A Reset must be performed before these settings become effective.

P+F-Talk treats both serial interfaces identically. Both serial ports will have the same <Timeout> and <Baud> parameter settings. The download port on the communicator (RS 232a) and the RS 485-2 wire port (port B) are operating ports. The <Timeout> and <Baud> parameters are also part of the setup string on the setup tag. The default value for <Baud> = 09600, indicating that port B will be configured as a 2-wire RS 485 interface. To configure port B as an RS 232 port, use <Baud> = 01202, 02402, 04802, 09602, or 19202. port B supports a baud rate of up to 38400 in the RS 485 mode. When selecting this baud rate, the RS 232a defaults to 19200. The RS 485-4 wire is not supported.

Date of Issue 11.07.2002

Configure microwave interface

Command:	**cm**<HeadN><Frequ>,<Range><CHK><ETX>
Response:	<Status><HeadN><CHK><ETX>
Display:	"cF" or "cr"

This command sets parameters necessary for communicating with a tag. These parameters are also part of the setup string on the setup tag. <Frequ> (xx) sets the microwave frequency of the communicator using numbers between 01 and 99 with a default value of <Frequ> = 50. <Range> (x) sets the read range of the communicator. This parameter can be between 1 to 4 with a default value of <Range> = 4.

Configure tag communication

Command:	**tc**<HeadN><ReadTimeout>,<Speed>,<Interval><CHK><ETX>
Response:	<Status><HeadN><CHK><ETX>
Display:	"rt", "tS" or "tI"

<ReadTimeout> specifies the time (xxx in 100 ms) intervals after which a "Single" command stops if <MV-Ops> = 1 or <MV-Ops> = 2. This parameter determines the number of tags in the field that will be read simultaneously. The default value is <ReadTimeout> = 030 (correspond to 3 seconds). These parameters are also part of the setup string on the setup tag and range from 001 to 999.

<Speed> (x) sets the microwave communications speed between the communicator and the tag. <Speed> = 1 indicates low read rate, while <Speed> = 2 indicates high read rate. This parameter is used when data is written to a tag. The default parameter is <Speed> = 2 since this is the speed necessary to communicate with a R/O tag.

<Interval> (xxx) specifies the time interval between individual data frames transmitted by the tag. This parameter is used only when writing a tag. <Interval> also determines whether a data carrier will be formatted to transmit data at random or constant intervals. R indicates random interval transmission and constant interval transmission is indicated by C. <Interval> is specified by three byte parameters using r00, r04, r08, and r16 (for random intervals) or c00, c04, c08, and c16 (for constant intervals). r00 and c00 are identical. The default = c08.

Reset default

Command:	**rd**<HeadN><CHK><ETX>
Response:	<Status><HeadN><CHK><ETX>
Display:	"rd"

This command sets all the communicator default values. The default values are defined in the "Pushbutton Configuration" section.

Date of Issue 11.07.2002

Setup help mode

Command:	**sh**<HeadN><Function><CHK><ETX>
Response:	<Status><HeadN><CHK><ETX>
Display:	"Sh"

<Function> (xx_{dec}) activates the allowable setup mode functions (ranging from 00 to 13). If port B is defined as RS 485 and a monitor mode setup help mode has been selected, changing the setup help mode or issuing a reset function can only be done via port A. Note that write beep mode (mode 12) can not be selected via serial (see "Display parameter and value tables" on page 38 and "Setup help modes" on page 68).

Configure doppler interface

Command:	**cd**<HeadN><Active><CHK><ETX>
Response:	<Status><HeadN><CHK><ETX>
Display:	"cd"

This commands turns doppler radar monitoring on and off. If activated the **gd** command is used to request doppler data. Doppler radar monitoring and reading tags can be active at the same time. A new set of doppler data is put in the buffer every <ReadTimeout>.

<Active> = nn turns on doppler radar monitoring using n as the threshold. Doppler data is buffered at a maximum rate of one set per <ReadTimeout>. <Active> = 00 deactivates the doppler radar. <Active> ranges from 00 to 30_{dec}.

The data is returned in the format (+/-)(xxx) where +/- indicated the direction of motion and xxx is a number between 000 and 255 indicating the speed. 000 is the slowest speed and 255 is the highest speed.

Note

That high threshold settings (<Active>) will generate many internal events that must be processed. This can result in loss of serial communications.

Date of Issue 11.07.2002

Get data (multidrop protocol only)

Command:	**gd**<HeadN><CHK><ETX>
Response:	<Status><HeadN><ExecCounter>{<Data>}<CHK><ETX>
Display:	"Not available"

This command requests data from the specified head. The execution counter <ExecCounter> indicates the number of tags stored (FIFO) in the tag buffer (including the data already requested). This number can go up, down or remain the same between two **gd** commands since buffered commands (**bf** and **br**) and enhanced (**ef** and **er**) remain active until cancelled or overwritten. <ExecCounter> = 0 indicates that all data has been requested from the tag buffer or that no data has been read at all and the command remains active. The maximum value of <ExecCounter> is 9. If more than 9 tags have been buffered, then the number remains 9. Once the **gd** command has been used, the request tag data from the communicator and the number of remaining tags is less than 9 and <ExecCounter> represents the true number of buffered tags. The <ExecCounter> = –ASCII (=2d$_{hex}$) value indicates that the tag buffer is empty and no command is active.

The value of the <ExecCounter> for single and auto commands enables the operator to differentiate between the "no tags read yet, command still active" (<ExecCounter> = 0) and the "no data left in buffer, command not active anymore" (<ExecCounter> = –ASCII) conditions.

<ExecCounter> = –ASCII will never occur for buffered commands since the commands remain active until cancelled.

If **gd** is issued without being preceded by a read command, <ExecCounter> = –ASCII will be returned indicating that no command is currently active and no tag data is available. After a Reset (**rs**) command is issued, the **gd** command replies with a <Status> = 2 and <ExecCounter> = –ASCII.

If the doppler interface is on <ExecCounter>, doppler data does not increase the <ExecCounter> value. Instead, the <ExecCounter> assumes a value of "D" when **gd** requests data and the communicator responds with doppler data. The operator should continue to issue the **gd** command until the read command has stopped in cases of the single or auto commands. The operator can continue to request doppler data using **gd** even after a single or auto command has stopped. No more than 25 entries should be logged before retrieval.

<Data> contains the tag data and (when activated) doppler read operations. In the case of doppler data <Data> = (Direction)sss, where (Direction) can be - indicating that an object is retreating or +, indicating that an object is approaching sss is a three digit speed between 000 and 255.

Date of Issue 11.07.2002

Get buffer (multidrop protocol only)

Command:	**gb**<HeadN><CHK><ETX>
Response:	<Status><HeadN><nn>{<CR><LF><ExecCounter><Status><BufferData>}<nn><CHK><ETX>
Display:	"Not available"

This command requests all data currently stored in the buffer from the specified head. All individual <ExecCounter> and <BufferData> sets are sent before <CHK><ETX>. <nn> indicates the number of data sets in the response. This number includes doppler data sets. Note that the <Status> in the { } relates to the function that caused this entry. The <Status> at the beginning of the response corresponds to the **gb** command function.

List configuration

Command:	**lc**<HeadN><CHK><ETX>Display NA
Response:	{list of current Settings}
Display:	"Lc"

This command requests a list of current settings on serial port A. Note that a similar command, list configuration can be executed with the push buttons. The difference between the **lc** command and the list configuration commands is that list configuration defaults to 9600 baud. This is useful if the current settings are unknown and serial communication can not be established, which is required to issue the **ls** command.

Date of Issue 11.07.2002

Example of a response to the **Ic** command:

Ic<CHK><ETX>

```
=====================================
==          PEPPERL + FUCHS        ==
==          MICROWAVE SYSTEM-T     ==
==          COMMUNICATOR SETTINGS  ==
==          Station ID: 00         ==
=====================================
Software Version
---------------
(c) P+F IDENT-M
MTT-S3
#054804
PFT V2.4
25.09.01

Serial Port Configuration
-------------------------
Serial Timeout: 005
Serial Baudrate: 09600
Serial Port B: RS-485
Serial Databits: 8
Serial Stopbits: 1
Serial parity: None

Microwave Interface Settings
----------------------------
Microwave Channel: 01
Microwave Range: 3
Microwave On: Hi Bt Rate S
Read Timeout: 005

Microwave Tag Settings
----------------------
Tag Speed: High Bitrate
Tag Interval: 00
Tag Interval Type: Constant

Help, Doppler, & Bypass Mode Settings
-------------------------------------
Help Mode: 00
Doppler Mode: 00
Bypass Configuration Tag: Off

Stored Command
--------------
Command: None Stored
```

Date of Issue 11.07.2002

Define master bit

Command:	**db**<HeadN><MasterBit><BitDef><CHK><ETX>
Response:	<Status><HeadN><CHK><ETX>
Display:	"Not available"

The Define master bit command (**db**) is used to assign a custom text message to one of 16 master status messages that are send out of serial port B, indicating the status of control system. <BitDef> is an eight character text string that is send to serial port B whenever at master status command is received in which the bit <MasterBit> has a value that is different from the previous value. The purpose of this command is to enable a Host computer to utilize the second serial port of the communicator. 16 master bits are available. The <Bitdef> text message has been implemented as a fixed length text message with 8 characters. If the user does not define messages the default messages associated with the individual master bits in "MstBit##".

<MasterBit> ranges from 00ASCII to 15ASCII.

Example: **db**<HeadN>01StartCMD<CHK><ETX>
This assigns the text string "StartCMD" to master bit 01.

Note

The master bit definitions are stored in battery backed RAM and will be lost if the communicator is not powered for extended periods. If master bit definitions are used the control code should have the ability to redefine them at power-up.

Date of Issue 11.07.2002

Get master bit

Command:	**gm**<HeadN><CHK><ETX>
Response:	<Status><HeadN><CR><LF> 00 <BitDef> {for bit 00}<CR><LF> 01 <BitDef> {for bit 01}<CR><LF> 02 <BitDef> {for bit 02}<CR><LF> 03 <BitDef> {for bit 03}<CR><LF> 04 <BitDef> {for bit 04}<CR><LF> 05 <BitDef> {for bit 05}<CR><LF> 06 <BitDef> {for bit 06}<CR><LF> 07 <BitDef> {for bit 07}<CR><LF> 08 <BitDef> {for bit 08}<CR><LF> 09 <BitDef> {for bit 09}<CR><LF> 10 <BitDef> {for bit 10}<CR><LF> 11 <BitDef> {for bit 11}<CR><LF> 12 <BitDef> {for bit 12}<CR><LF> 13 <BitDef> {for bit 13}<CR><LF> 14 <BitDef> {for bit 14}<CR><LF> 15 <BitDef> {for bit 15}<CR><LF><CHK><ETX>
Display:	"Not available"

The Get master bit command (**gm**) instructs the communicator to generate a list that contains the current definitions of the master bits.

Example: Assume the following text message assignments have been performed previously

db00StartCMD<CHK><ETX>
db01Done-CMD<CHK><ETX>
db03ClearCMD<CHK><ETX>
db08Data OK<CHK><ETX>
db11ClearACK<CHK><ETX>
db14EmptyCMD<CHK><ETX>

When issuing the **gm** command the following will be send to the serial port (assuming non-multidrop operation):

0
00 StartCMD
01 Done-CMD
02 MstBit02
03 ClearCMD
04 MstBit04
05 MstBit05
06 MstBit06
07 MstBit07
08 Data OK
09 MstBit09
10 MstBit10
11 ClearACK
12 MstBit12
13 MstBit13
14 EmptyCMD
15 MstBit15<CHK><ETX>

Date of Issue 11.07.2002

Master status

Command:	**ms**<HeadN><MStatusBits><CHK><ETX>
Response:	<Status><HeadN><CHK><ETX>
Display:	"Not available"

The master status command (**ms**) sends 4 bytes corresponding to the master bits <MStatusBits> to the communicator. Each byte defines the hex value of 4 bits (ASCII coded hex). The communicator compares the value of the <MStatusBits> with those values of the last transmission and generates debug messages for all bits that have toggled. The start-up value of the <MStatusBits> is 0000.

Example:

Last <MStatusBits> sent by master to communicator "0101".
New <MStatusBits> sent by master "0102".

Bit 8 did not change value and no message is generated,
Bit 1 toggled from 0 to 1 and the message "MstBit01 ON" is generated,
Bit 0 toggled from 1 to 0 and the message "MstBit00 OF" is generated.

If a custom string has been assigned to the master bits (using the **db** command), those are sent instead of the "MstBit##" string.

Date of Issue 11.07.2002

8.2.3 Read commands

The MTT-□□-S3 can read multiple tags in field depending of the configuration (<MV-Ops> parameter). If multiple tags in field has been enables (<MV-Ops> = 1 or 2) a single command will remain active (i. e. will scan for tags in the field) until read timeout has expired. All tags read within this time limit will be reported. If multiple tags in field has been disabled (<MV-Ops> = 3 or 4) the communicator will stop scanning once it read one tag. In both cases, if no tags are in the field the command halts execution after read timeout, issuing a status = 5. If the communicator is operated in multidrop mode **gd** command must be issued to request replies. The timing behaviour explained above remains unchanged. The <ReadTimout> parameter is used to specify the time the communicator will "listen" for tags. This has different effects for the different "versions" of the command (single vs. auto vs. buffered vs. enhanced).

Note

*<HeadN>, <WordAdr> and <NWord> are all hex numbers. The get data command (**gd**) only exists in multidrop mode. In point to point operation the communicator replies immediately*

Single read

Command:	**sr**<HeadN><WordAdr><NWord><CHK><ETX>
Response:	<Status><HeadN><CHK><ETX>
Display:	"Not available"

The communicator tries once to read <NWord> (xx_{ASCII}) 32-bit words at address <WordAdr> (xx_{hex}). After the tag has been read, the data is sent to the controller or stored until requested using the **gd** command. The single read operation will "look" for tags for <ReadTimeout> after initiation of the command. During this time interval, all tags in the communication zone are read once. After <ReadTimeout> or after the first tag has been read (depending on <MV-Ops> setting), the command stops and may be re-issued. If no tag is read during the <ReadTimeout> interval, the command stops and may be re-issued. Old data will no longer be available if a new **sr** command is issued before data has been removed from the buffer.

Date of Issue 11.07.2002

Auto read

Command:	**ar**<HeadN><WordAdr><NWord><CHK><ETX>
Response:	<Status><HeadN><CHK><ETX>
Display:	"Not available"

The communicator tries to read <NWord> 32-bit words at the address <WordAdr> until at least one tag is read or until the command is overwritten by another valid command. After the first tag is read, a <ReadTimeout> timer starts and all other tags that fall within the <ReadTimeout> interval are also read. If multiple tags in field has been disabled (<MV-Ops> = 3 or 4) the command stops after the first tag has been read. After the tag has been read, the data is sent to the controller or stored until requested using the **gd** command (multidrop). After the <ReadTimeout> timer has expired, the command stops and may be re-issued. The reset or quit command can be used to stop this command. The timer is reset and a new interval begins if a new **ar** command is issued before the <ReadTimeout> interval has expired. Old data is no longer available if a new **ar** command is issued before the buffer has been cleared of data.

Buffered read

Command:	**br**<HeadN><WordAdr><NWord><CHK><ETX>
Response:	<Status><HeadN><CHK><ETX>
Display:	"Not available"

The communicator will read <NWord> 32-bit words at the address <WordAdr> until the command is cancelled using the reset or quit command, or until it is overwritten by another valid command. After the tag has been read, the data is sent to the controller or stored until requested using the **gd** command (multidrop). A tag will not be re-read unless it leaves the read zone for a period longer than the <ReadTimeout>. For example, the operator will not get the tag data when issuing the **gd** command (multidrop). If a tag leaves the read zone for a period longer than the <ReadTimeout> interval, the tag will be considered "new" and can be queried by **gd** again. The maximum of 25 tag entries can be buffered internally (i. e. stored such that **gd** can re-quest the data) before issuing a **gd** command. The execution counter is kept at 9 although more than 9 events are buffered. When the **gd** command is executed, 9 will be the start point of the count down. Data will be cleared from the tag buffer once it has been requested using the get data command (**gd**).

Date of Issue 11.07.2002

Enhanced read

Command:	**er**<HeadN><WordAdr><NWord><CHK><ETX>
Response:	<Status><HeadN><CHK><ETX>
Display:	"Not available"

The communicator will read <NWord> 32-bit words at the address <WordAdr>. After the tag has been read, the data is sent to the controller or stored until requested using the **gd** command (multidrop mode). If the tag remains in the read zone, then the data is not sent to the controller again. The following occurs if the tag leaves the read-zone:

The communicator continues to attempt to read the tag. The communicator sends a <Status> = 5 to indicate the tag has left the read zone if it does not read that tag again for a period of three <ReadTimeout> or 2 seconds (whichever is longer). The enhanced command is cancelled when more than one tag is in the field since this function can not be implemented when multiple tags are in the field. This includes situations where an R/W data carrier and an R/O code carrier are in the field simultaneously. A <Status> = A is generated when this happens. Tag data can then be requested using the get data command (**gd**).

Single fixed read

Command:	**sf**<HeadN><CHK><ETX>
Response:	<Status><HeadN><CHK><ETX>
Display:	"Not available"

The MTT-□□-S3 makes one attempt to read the fixcode of a tag. After the tag has been read, the data is sent to the controller or stored until requested using the **gd** command (multidrop). The single fixed read operation will "look" for tags for <ReadTimeout> after initiation of the command. All tags in the communication zone are read once during this time interval. The command stops and may be re-issued after the <ReadTimeout> interval or after the first tag has been read (depending on <MV-Ops> setting). The command also stops and can be re-issued if a tag is not read during the <ReadTimeout>. If a new **sf** command is issued before the <ReadTimeout> interval has expired, the timer is reset and a new interval begins. Old data will no longer be available if a new **sf** command is issued before the buffer has been cleared of data.

Date of Issue 11.07.2002

Auto fixed read

Command:	**af**<HeadN><CHK><ETX>
Response:	<Status><HeadN><CHK><ETX>
Display:	"Not available"

The MTT-□□-S3 tries to read the fixcode until at least one tag was read or another valid command has been received. After a tag is read, a <ReadTimeout> timer starts and all other tags that fall within that time interval are also read. If multiple tags in field has been disabled (<MV-Ops> = 3 or 4) the command stops after the first tag has been read. After the tag has been read, the data is sent to the controller or stored until requested using the **gd** command (multidrop). After the <ReadTimeout> timer has expired the command stops and may be re-issued. This command can be stopped using the reset or quit command. If a new **af** command is issued before the <ReadTimeout> interval has expired, the timer is reset and a new interval starts. If a new **af** command is issued before data has been removed from the buffer, old data will not be available any longer.

Buffered fixed read

Command:	**bf**<HeadN><CHK><ETX>
Response:	<Status><HeadN><CHK><ETX>
Display:	"Not available"

The MTT-□□-S3 will read fixcodes until the command is actively stopped using the reset or quit command or another valid command has be received. After the tag has been read, the data is sent to the controller or stored until requested using the **gd** command (multidrop). If a tag remains in the read zone it will not be re-read, i. e. the user will not get the tag data again when issuing **gd**. If a tag leaves the read zone for more than <ReadTimeout> the tag will be considered "new" and can be requested by **gd** again (multidrop). To guarantee the performance of the MTT-□□-S3 the maximum number of tags buffered before a **gd** command must be limited to 25 tag entries. Once data has been requested using the **gd** get data command it will be cleared from the tag buffer.

Date of Issue 11.07.2002

Enhanced fixed read

Command:	**ef**<HeadN><CHK><ETX>
Response:	<Status><HeadN><CHK><ETX>
Display:	"Not available"

The MTT-□□-S3 will read the fixcode. After the tag has been read, the data is sent to the controller or stored until requested using the **gd** command (multidrop). If the tag re-mains in the read zone the data is not sent to the controller again. If the tag leaves the readzone the following takes place.

The communicator continues to attempt to read the fixcode. If it does not read that tag again for three <ReadTimeout> periods or 2 seconds (whichever is longer) the communicator sends a <Status> = 5 to indicate that the tag left. Since this function can not be implemented using multiple tags in field the enhanced command terminates if at any given point in time more than one tag is in the field. This also includes situations where a R/W data carrier and a R/O code carrier are in the field at the same time. Should this happen a <Status> = A is generated. Tag data can be requested using the get data **gd** command.

Date of Issue 11.07.2002

8.2.4 Write commands

Writing of IDENT-M System T data carriers is only possible if no more than one data carrier is in the read zone (i. e <Range> = 4). During the writing process the data carriers are not just "written" but also formatted. Because a data carrier can only be written in its entirety, storing data a particular address on the tag requires multiple steps:

1. Reading of the data carrier (using <Range> = 1)
2. Determine that data can fit onto the data carrier
3. Entering the new data at the desired location in the string
4. Determining the necessary tag memory model (Mini, Quarter, Full)
5. Checking if any other tag is in the read range (read for <ReadTimeout> seconds at <Range> = 4). If a tag is found data will not we be written
6. If no tag was found the full string will be written

Since smaller memory models increase the performance of the system the smallest possible memory model must be used. To simplify the operation for the user P+F-Talk uses memory expansion and contraction.

Note

Buffered write and enhanced write commands do not exist for the MTT-□□-S3 communicator's write operations.

Note

If multiple tags in the field are found prior during the initial phase of a write (step 5 in the above sequence) the running command is terminated immediately and a <Status> = B is reported. In multidrop a <Status> = 5 is combined with an <ExecCounter> = 0.

Single write

Command:	**sw**<HeadN><WordAdr><NWord><Data><CHK><ETX>
Response:	<Status><HeadN><CHK><ETX>
Display:	"sw"

The MTT-□□-S3 tries once to write <NWord> (xx) 32-bit data at data carrier address <WordAdr> (xxxx). Before initiating the write operation the MTT-□□-S3 checks a tag is in the <Range> = 1 field. If the write operation was successful the **gd** command returns <Status> = 0 (no error) and <ExecCounter> = 1 (one write operation performed). If no data was written to a tag **gd** yields <Status> = 0 (no error) and <ExecCounter> = 0 (command active). If the write failed **gd** yields <Status> = 5 and <ExecCounter> = 0 (command not active). If a new command is issued after a write operation failed, the write operation is activated again.

Date of Issue 11.07.2002

Auto write

Command:	**aw**<HeadN><WordAdr><NWord><Data><CHK><ETX>
Response:	<Status><HeadN><CHK><ETX>
Display:	"Not available"

The MTT-□□-S3 tries to write <NWord> 32-bit data at data carrier address <WordAdr> until successful. Before initiating the write operation the MTT-□□-S3 checks a tag is in the <Range> = 1 field. If the write operation was successful the **gd** command returns <Status> = 0 (no error) and <ExecCounter> = 1 (one write operation performed). If no data was written to a tag **gd** yields <Status> = 0 (no error) and <ExecCounter> = 0 (command active). If a new command is issued after a write operation failed, the write operation is activated again.

Format tag

Command:	**ft**<HeadN><CHK><ETX>
Response:	<Status<Head><CHK><ETX>
Display:	"ft"

This command formats the code/data carriers setting all bits to zero. It also guarantees that the tag is in mini-memory once the command is executed. In multidrop mode this command sends a status after completion. This command does not go through the test procedure outlined on the previous page. Since it does not scan for multiple tags in field before writing it must not be used in control applications.

Single configuration tag write

Command:	**cw**<HeadN><CHK><ETX>
Response:	<Status><HeadN><CHK><ETX>
Display:	"st"

This command writes all parameters pertaining to the current configuration to a tag. This command does not go through the test procedure outlined on the previous page. Since it does not scan for multiple tags in field before writing it must not be used in control applications.

Date of Issue 11.07.2002

8.2.5 Input/Output commands

The following functions set and read digital I/O, turn the buzzer on and off and define the colour of the main LED (visible through the cover).

Define output

Command:	**do**<HeadN><8-byte pattern><CHK><ETX>
Response:	<Status><HeadN><CHK><ETX>
Display:	"Not available"

Sets and resets digital outputs (bits 0 and 1) and relay (bit 2). This command also handles "external LED 1" (bit 3) and "external LED 2" (bit 4).

<8-byte pattern> ($x_{(MSB)}xxxxxxx_{(LSB)}$) is an 8 byte pattern composed on ASCII 1 s and 0 s. Each byte in the 8-byte pattern corresponds to one output.

Get input/output

Command:	**gi**<HeadN><CHK><ETX>
Response:	<Status><HeadN><16-byte pattern><CHK><ETX>
Display:	"Not available"

Reads the status of all digital inputs and outputs. The first 8 bytes are the state of the outputs and the second 8 bytes are the state of the inputs:

$x_{(MSB)}xxxxxxx_{(LSB)}$ $x_{(MSB)}xxxxxxx_{(LSB)}$

outputs inputs

Start/Stop buzzer

Command:	**bz**<HeadN><Buzzer-Ops><CHK><ETX>
Response:	<Status><HeadN><CHK><ETX>
Display:	"Not available"

This command turns the buzzer on (<Buzzer-Ops> = 1) or off (<Buzzer-Ops> = 0). P+F-Talk does not allow changing the frequency and the duty cycle of the buzzer.

Beep

Command:	**be**<HeadN><CHK><ETX>
Response:	<Status><HeadN><CHK><ETX>
Display:	"Not available"

This command instructs the buzzer to generate a short beep.

Date of Issue 11.07.2002

Main LED on/off

Command:	**Id**<HeadN><Color><CHK><ETX>
Response:	<Status><HeadN><Chk><ETX>
Display:	"Not available"

This function specifies the colour of the main LED and turns it on and off. <Color> (x) is one byte with values 0 (off), 1 (green), 2 (red), 3 (amber), 4 (green slow blinking), 5 (red slow blinking), 6 (amber slow blinking), 7 (green fast blinking), 8 (red fast blinking) and 9 amber fast blinking).

Date of Issue 11.07.2002

8.2.6 Automatic command execution

The MTT-□□-S3 is capable of automatically executing stored commands. Using one of the help modes (**sh** command, defined later) it is possible to turn the MTT-□□-S3 into a configurable wedge-reader.

Configuration store

Command: **cs**<On/Off><HeadN><CHK><ETX>
Response: <Status><HeadN><CHK><ETX>
Display: "cs"

After receiving the **cs** command with the <On/Off> = 1 parameter the MTT-□□-S3 expects another command string. This command string is not executed but stored. At the next power-up or after a reset the MTT-□□-S3 automatically performs the stored command. This automatic command execution remains active until turned off using the configuration store commands with <On/Off> = 0 parameter or the communicator is "Reset default". If the communicator operates in a multidrop environment, it is the users responsibility to make sure that the stored command string is compatible with multidrop operation.

The following commands can be used with "configuration store":

Version	**ve**
Microwave interface on/off	**mi**
Configure serial interface	**ci**
Configure microwave interface	**cm**
Configure tag communication	**tc**
Reset default	**rd**
Setup help mode	**sh**
Configure doppler interface	**cd**
Single read	**sr**
Auto read	**ar**
Buffered read	**br**
Enhanced read	**er**
Single fixed read	**sf**
Auto fixed read	**af**
Buffered fixed read	**bf**
Enhanced fixed read	**ef**
Single write	**sw**
Auto write	**aw**
Define output	**do**
Get input/output	**gi**
Start/Stop buzzer	**bz**
Beep	**be**
Main LED on/off	**ld**

Date of Issue 11.07.2002

Examples

A stored configuration can be used to:

1. Automatically turn on an output after power up
2. Automatically start reading a tag. It is still necessary to issue **gd** to receive the data (using help mode it is possible to configure the MTT-□□-S3 to automatically send data to the host. The get data command is not necessary.)
3. Automatically reset the MTT-□□-S3 to use all default values at power up
4. Turn on the main LED to indicate that the unit is powered up. The LED must be turned off using the **ld** command
5. Initiate a beep to indicate that the unit was reset or powered up

Date of Issue 11.07.2002

8.2.7 Other features

Automatic cover switch monitoring

If the cover switch was triggered, the communicator responds with <Status> = 9 after the next command. The following must be considered. If the operation generates anything else than <Status> = 0 this status will be sent. Thus (only if the operation was successful and would usually result in a <Status> = 0) is the cover switch trigger sent (see status message levels.). Removal of the cover also causes the beeper to beep three times.

Automatic battery low indication

If a tag sends its internal battery low flag the communicator responds with <Status> = 1. The following must be considered. If a read or write operation fails and the battery low condition was detected the <Status> indicating the failed operation takes precedence over the low battery flag. <Status> = 1 will be sent if the previous operation was successful (resulting in <Status> = 0). See status message levels.

Setup help modes

Command:	**sh**<HeadN><Function><CHK><ETX>
Response:	<Status><HeadN><CHK><ETX>
Display:	"Sh"

Setup help modes are predefined features that use the main LED, beeper, serial ports and outputs to help during setup and trouble shooting. Setup help mode 12 can only be selected via the pushbuttons. All functions can be turned off using the push-buttons, or initiating a "Reset default". Using such a mode enables the communicator to operate as a wedge reader.

Mode 00: Normal operation without any modification

Mode 01: Normal operation with beep support
One beep when any tag is read
Two beeps when tag is written to

Mode 02: Normal Operation with LED support
Main LED green = Always green except when turned red or amber
Main LED red = Tag written
Main LED amber = Tag read

Mode 03: Normal Operation with R/O -- R/W indication
Main LED green = R/W tag read
Main LED amber = R/O tag read

Mode 04: Normal Operation with input monitor
Main LED green = Input 1 high
Main LED red = Input 2 high
Main LED amber = Input 1 and input 2 high
Beeper on = Input 3 high

Date of Issue 11.07.2002

Mode 05: Monitor mode without conditions
Read tag and send string to both serial parts using active serial port parameters. Ignore serial commands (except "Reset", "Reset default" (on any port) and downloads on RS 232 download port, i. e. port A).

Mode 06: Monitor mode without conditions – Same as mode 05 but string does not have a leading status or trailing checksum and <ETX>. A <CR><LF> is appended to the data for simple usage with any terminal.

Mode 07: Monitor mode with condition. Ignore serial commands (except "Reset", "Reset default" and downloads).
Read tag and send string to serial port 1
Send to serial port 2 if any input is high at the time the tag is read.

Mode 08: Monitor mode with conditions – Same as mode 07 but string does not have a leading status or trailing checksum and <ETX>. A <CR><LF> is appended to the data for simple usage with any terminal.

Mode 09: Monitor mode with condition. Ignore serial commands (except resets and downloads).
Read tag and send string to serial port 2
Send to serial port 1 if any input is high at the time the tag is read.

Mode 10: Monitor mode with conditions – Same as mode 09 but string does not have a leading status or trailing checksum and <ETX>. A <CR><LF> is appended to the data for simple usage with any terminal.

Mode 11: Read beep

Mode 12: Write beep

Date of Issue 11.07.2002

Mode 13: Single command halt status – This mode modifies the behaviour of the single read (**sr**) and single fixed read (**sf**) commands. Without this modification the user does not know when the command stops executing after a tag was read. When no tag is in the field, a reply with <Status> = 5 is returned. This is clear indication that the <ReadTimeout> has expired and the communicator is not scanning for tags anymore. In contrast, when a tag was read the user does not know when this timer has expired. Mode 13 solves this issue by sending an additional status reply (<Status> = 5) after <ReadTimeout> even if a tag was previously read and sent to the host computer. Based on this feedback it is then possible to control applications that does not have to relay on internal timers to estimate when a new **sr** or **sf** command should be sent to the communicator.

Additionally, the following text messages are generated on serial port B:

Scanning	when a single read or single fixed read command has been activated.
Stopped Scanning	once the single read or single fixed read command has stopped after <ReadTimeout>
Reading <Data>	when a tag is read the <Data> is displayed

If mode 05 to 10 are selected and a valid configuration has been stored in the MTT-□□-S3, only the specified data are sent to the appropriate serial port. If no configuration has been stored or if the configuration does not specify a read function, the full contents of the tag is send to the host. Also, while in monitor mode (mode 05 to 10) single, auto, buffered and enhanced read operation are identical, i. e. P+F-Talk automatically repeats the specified function.

Date of Issue 11.07.2002

8.2.8 Status messages and message levels

All status messages have a numerical level defining the importance of that message. A message with a lower numerical level will take precedence over a message with a higher level if both are applicable.

<8-byte pattern>:	8 character string comprised of ASCII 1's and 0's. Used to set the state of the communicator outputs.
<16-byte pattern>:	6 character string comprised of ASCII 1's and 0's. Communicator reply containing the current state of the communicators outputs (most significant 8 digits) and the state of the communicators input (least significant 8 digits).
<Active>:	2 character parameter specifying the Doppler radar threshold. 00 turns off Doppler radar, 01 to 30 turns on Doppler radar.
<Ad-Parameter>:	2 character multidrop addresses to be assigned to communicator.
<Baud>:	5 character parameter specifying the baud rate of the serial interface. Valid values are 01200, 02400, 04800, 09600, or 19200.
<BitDef>:	8 character text string defining the custom message of a master bit. Any 8 characters can be used.
<BufferData>:	Same as <Data>. Used in conjunction with the get buffer command.
<Buzzer-Ops>:	1 character parameter specifying the state of the buzzer: 0 = buzzer off, 1 = buzzer on.
<CHK>:	1 ASCII character, 8-bit checksum by means of all proceeding characters, without overrun.
<Color>:	1 character parameter specifying the color and blink speed of the main LED. Valid range 0 to 9.
<Data>:	<NWord> times 4 Bytes
<Date>:	
<ETX>:	1 ASCII 03 character.
<ExecCounter>:	The number of successful read/write attempts is displayed in the execution counter when a read/write command is activated before the get data command. The execution counter has the value – if the data of a previously active command has already been retrieved or a system command has been sent. It counts the successfully executed read attempts. The maximum value at which the counter stops is 9.
<Frequ>:	2 character parameter specifying the microwave channel to be used by communicator. Valid range 01 to 99.
<Function>:	2 character parameter specifying the setup help mode. Valid range is 00 to 11 and 13. Setup help mode 12 cannot be issued via the serial interface.
<HeadN>:	Read head number 2 ASCII characters, range of 01 to 30.
<Interval>:	3 character parameter specifying the time interval between individual data frames transmitted by the tag only when writing a tag. Valid values are r00, r04, r08, and r16 (for random intervals) or c00, c04, c08, and c16 (for constant intervals).

Date of Issue 11.07.2002

<MasterBit>: 2 character parameter specifying one of the 16 master bits. Valid range 00ASCII to 15ASCII.

<MStatusBits>: 4 character parameter specifying the status that the master is sending to the communicator. Each byte range can take values 0 to 9 and A to F.

<MV-Ops>: 1 character microwave bit rate between communicator and tag:
0 =microwave off (disables tags reading and writing),
1 = enables reading of tags that are formatted to low read rate. Multiple tags can be read within one "Read timeout" period,
2 = enables reading of tags that are formatted to high read rate. Multiple tags can be read within one "Read timeout" period,
3 = enables reading of tags that are formatted to low read rate. Only one tag can be read within one "Read timeout" period,
4 = enables reading of tags that are formatted to high read rate. Only one tag can be read within one "Read timeout" period.

<NWord>: Number of words to be read or written, 2 ASCII characters. Range 00hex to FFhex depending on data carrier type.

<On/Off>:

<PartNumber>:

<Range>: 1 character parameter specifying the read range of the communicator. Valid range 1 to 4.

<ReadTimeout>: 3 character parameter specifying the length (in 100 ms) a single read or single fixed read remains active (<MV-Ops> = 1 or <MV-Ops> = 2). This setting also used by the write command and the enhanced red command. Valid range 001 to 999.

<Speed>: Specify the microwave bit rate a tag and should use to communicate with the communicator. When writing data to the tag, the tag is also formatted to use this <Speed>. After the write the communicator must use an <MV-Ops> that matches <Speed> in order to communicate with the tag.
1 = low read rate, 2 = high read rate.

<Status>: 1 ASCII character:

Level 1		Level 2		Level 3		Level 4	
2	Switch-on or reset message, MTT-□□-S3 ready	**1**	Tag battery low	**9**	Cover switch trigger occurred	**0**	No error
4	Incorrect or incomplete instruction, or parameter not in valid range						
5	Read error or write error						
A	Multiple tags in field while executing an enhanced command						
B	Multiple tags in field while executing a write command						

Date of issue 11.07.2002

<SW-Number>:
<Timeout>:
<TT>:
<WordAdr>: range 00_{hex} to $1F_{hex}$
#<CR>:
<CR><LF>:

Date of Issue 11.07.2002

Date of Issue 11.07.2002

9 Fault diagnostics

9.1 Functions test

The setup help function can be used to trouble shoot the communicator. Please refer to section 8.2.7.

9.2 Device diagnostics through a serial interface

9.2.1 Testing communications using the serial interfaces

Test the following if communication does not occur over the serial interfaces:

- Check all electrical connections (cables, plugs, solder connections etc.).
- Ensure that the interface cable is connected to the correct COM port.
- Ensure that the MTT-□□-S3's transmission parameters (default: 9600 Bit/s, 8 databits, 1 stopbit, no parity) match the transmission parameters of the host/terminal.
- Check communications on the communicators other serial interfaces.

Individual device functions can be tested in several ways once serial communications are functioning properly on the MTT-□□-S3 communicator:

- All important device functions can be easily tested with the accompanying test software.

9.2.2 Debug modes

P+F-Talk offers powerful debug methods. To enter debug mode the following must happen:

- The debug initiation command will only be accepted for the first 60 seconds after a reset or power-up.
- The command can only be issued on RS 232 port A.
- If the command is issued on port B the MTT-□□-S3 responds with a <Status> = 4 message.
- The debug responses are issued at RS 232 port A only.

Command: **?@**<Mode><CHK><ETX>

<Mode> is a one digit number defining the following features:

<Mode>	Feature
1	Echo all. All serial data received by MTT-□□-S3 is echoed to port A. In a multidrop environment, this includes even commands not intended for this MTT-□□-S3. Using this feature it is possible to turn the MTT-□□-S3 into a line listening device.
2	Echo address specific. All serial data received by and intended for this MTT-□□-S3 is echoed to port A. This is a subset of <Mode> = 1 and offers powerful debugging at ONE specific MTT-□□-S3.

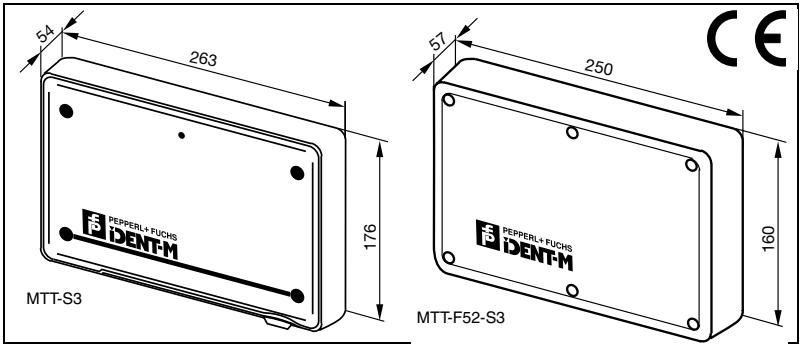
Date of Issue 11.07.2002

<Mode>	Feature
3	Tag type. This command sends a message to RS 232 port A concerning the type and formatting of any tag read by the microwave interface (type indication see next table).
4	Buffered record. This mode is only possible in a multidrop environment. When data and formatting of any tag read by the internal buffer (via the **gd** or **gb** command) a message is generated.

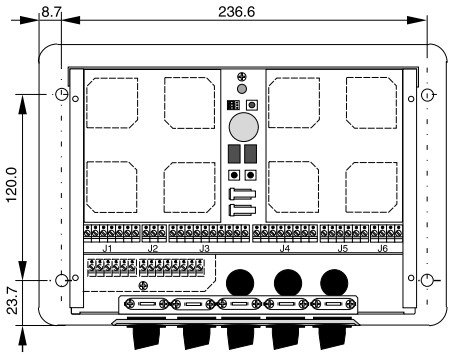
<Mode> = 3 Type indication (low bit rate)	<Mode> = 3 Type indication (high bit rate)	Tag format
0000 and 0001	0080 and 0081	M-C-0
0008 and 0009	0088 and 0089	F-C-0
0010 and 0011	0090 and 0091	W-C-0
0020 and 0021	00A0 and 00A1	M-C-4
0022 and 0023	00A2 and 00A3	M-C-16
0024 and 0025	00A4 and 00A5	M-C-8
002A and 002B	00AA and 00AB	F-C-16
002C and 002D	00AC and 00AD	F-C-8
0028 and 0029	00A8 and 00A9	F-C-4
0030 and 0031	00B0 and 00B1	Q-C-4
0032 and 0033	00B2 and 00B3	Q-C-16
0034 and 0035	00B4 and 00B5	Q-C-4
0060 and 0061	00E0 and 00E1	M-R-4
0062 and 0063	00E2 and 00E3	M-R-16
0064 and 0065	00E4 and 00E5	M-R-8
0068 and 0069	00E8 and 00E9	F-R-4
006A and 006B	00EA and 00EB	F-R-16
006C and 006D	00EC and 00ED	F-R-8
0070 and 0071	00F0 and 00F1	Q-R-4
0072 and 0073	00F2 and 00F3	Q-R-16
0074 and 0075	00F4 and 00F5	Q-R-8

Date of Issue 11.07.2002

10 Technical data

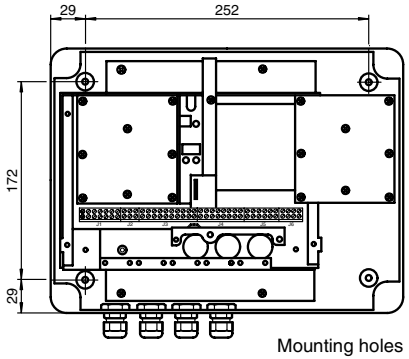


MTT-S3
MTT-F52-S3



Mounting holes ∅4.2 mm

MTT6000-F51-S3



Mounting holes ∅4.2 mm

Date of Issue 11.07.2002

Technical Data Model number	MTT-S3	MTT-F52-S3	MTT6000-F51-S3
Nominal ratings:			
Operating frequency	2.435 ... 2.465 GHz, 99 ID-channels Channel spacing 300 kHz		
Polarization	circular		
Read transfer rate	4 kBit/s, 16 kBit/s		
Read range	0 m ... 4 m	0 m ... 4 m	0 m ... 6 m
Write transfer rate	4 kBit/s		
Write range	0 m ... 0.5 m		
Motion recognition	0.3 m/s ... 9.2 m/s		
Motion recognition range	max. 5 m		
Flash EEPROM storage	384 kByte	384 kByte	384 kByte
SRAM storage	128 kByte	128 kByte	128 kByte
Environmental conditions			
Operating temperature	253 Kelvin ... 333 Kelvin (-20 °C ... 60 °C)		
Storage temperature	253 Kelvin ... 333 Kelvin (-20 °C ... 60 °C)		
Impact resistance	40G, 6 ms, 1000x in all 3 spatial axes per IEC 68-2-29 Eb		
Shock resistance	15G, 6 ms, 10x in all 3 spatial axes per IEC 68-2-27 test Ea		
Vibration resistance	5G, 0.55 mm, 50 Hz per IEC 68-2-6 Fc		
Solar irradiation	1120 W/m^2, 56 days per IEC 68-2-5 Sa C		
Protection class to EN 60529	IP43	IP65	IP56
R&TTE certification	CE0413		
Mechanical			
Dimensions (W x H x D)	263 x 176 x 54	250 x 160 x 57	315 x 234 x 128
Mounting	4 mounting holes, 4.2 mm diameter		
Housing material (face)	PC	ABS	PC
Housing material (back)	stainless steel	ABS	PC
Weight	1.9 kg	1.7 kg	3.0 kg
Power supply			
Supply voltage DC	20 V ... 28 V	20 V ... 28 V	20 V ... 28 V
Current consumpt. at 24 V DC	150 mA	150 mA	150 mA

Date of Issue 11.07.2002

Internal view MTT-S3

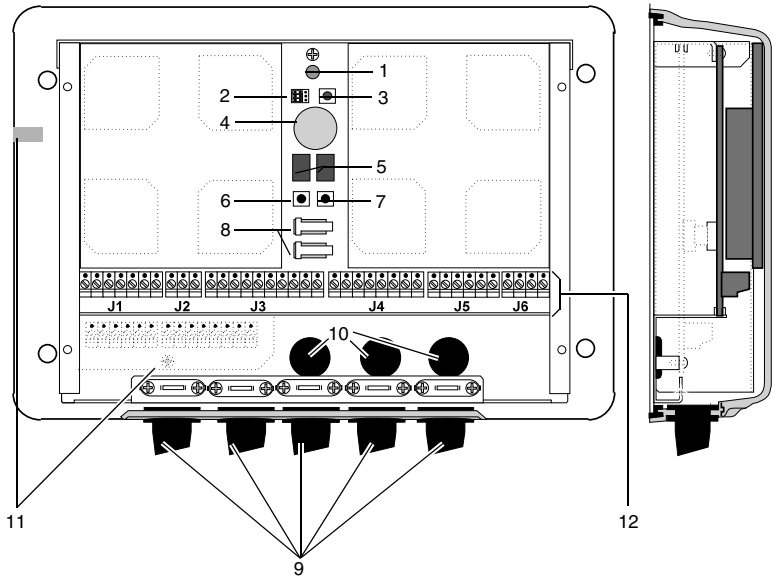
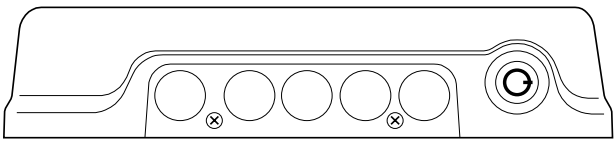


Illustration of hardware features:

1 Multicolored LED
2 Jumper field
3 Not used
4 Buzzer
5 7-segment display, two-digit
6 "Parameter-Selection" button
7 "Value-Selection" button
8 Housing switch
9 Cable connection access, bottom
10 Cable connection access, back (prepared)
11 Ground terminals
12 Connection terminal block

Cable entry, bottom

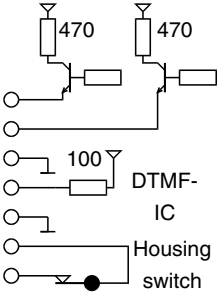


Date of Issue 11.07.2002

Connection terminal block assignments

Terminal block J1:

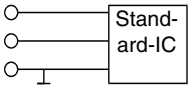
Terminals	Signal	Meaning	
J1-1	LED 1	LED output 1	**J1-1**
J1-2	LED 2	LED output 2	**J1-2**
J1-3	GndLED	Ground LED output	**J1-3**
J1-4	SDTMF	DTMF interface	**J1-4**
J1-5	RtnDTMF		**J1-5**
J1-6	Tamp a	Housing switch	**J1-6**
J1-7	Tamp b		**J1-7**



Technical data DTMF interface	MTT-S3	MTT-F52-S3	MTT6000-F51-S3
	2-wire interface for the reception of a dual tone signal and the power supply of a DTMF device		
Line voltage at 10 mA	min. 4.1 V; max. 4.5 V		
Sound level	min. -26 dB; max. 0 dB		

Terminal block J2:

Terminals	Signal	Meaning	
J2-1	Tx 232a	RS232 interface A	**J2-1**
J2-2	Rx 232a		**J2-2**
J2-3	Gnd 232a		**J2-3**

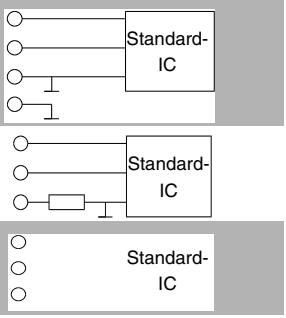


Technical data serial port A, RS232	MTT-S3	MTT-F52-S3	MTT6000-F51-S3
Standard values	9600 Bit/s, 8 Bits, no parity, 1 Stop-Bit		
Transfer rate	1200, 2400, 4800, 9600 or 19200 Bit/s		
No. of data bits	7 or 8		
No. of stop bits	1 or 2		
Parity	no, odd or even		

Date of Issue 11.07.2002

Terminal block J3:

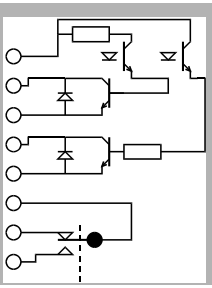
Terminals	Signal	Meaning	
J3-1	Tx 232b	RS232 interface B	J3-1
J3-2	Rx 232b		J3-2
J3-3	Gnd 232b		J3-3
J3-4	CGnd	common ground	J3-4
J3-5	Tx–/Rx– 485	RS485 interface	J3-5
J3-6	Tx+/Rx+ 485		J3-6
J3-7	Gnd485t		J3-7
J3-8	Rx 485–		J3-8
J3-9	Rx 485		J3-9
J3-10	Gnd 485r		J3-10



Technical data serial port B, RS232/RS485	MTT-S3	MTT-F52-S3	MTT6000-F51-S3
RS485 selection	Full-duplex (4-wire) or half-duplex (2-wire)		
Standard values	9600 Bit/s, 8 Bits, no parity, 1 Stop-Bit		
Transfer rate	1200, 2400, 4800, 9600, 19200 or 38400 Bit/s		
No. of data bits	7 or 8		
No. of stop bits	1 or 2		
Parity	no, odd or even		

Terminal block J4:

Terminals	Signal	Meaning	
J4-1	Outspl1	Voltage outputs	J4-1
J4-2	Out 1c	Output 1, collector	J4-2
J4-3	Out 1e	Output 1, emitter	J4-3
J4-4	Out 2c	Output 2, collector	J4-4
J4-5	Out 2e	Output 2, emitter	J4-5
J4-6	R1c	Relay output	J4-6
J4-7	R1b		J4-7
J4-8	R1m		J4-8

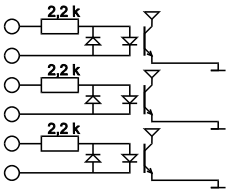


Date of Issue 11.07.2002

Technical data outputs	MTT-S3	MTT-F52-S3	MTT6000-F51-S3
Optical coupling outputs	2, open-collector, galvanically isolated		
Allowable voltage range	min. 1.0 V; max. 30.0 V		
Current range, output 1	min. 0.0 mA; max. 500 mA		
Current range, output 2	min. 0.0 mA; max. 100 mA		
Relay output			
Switch voltage DC	max. 220 V		
Switch voltage AC	max. 48 V		
Switch current	max. 2 A		
Switch load	max. 50 W		

Terminal block J5:

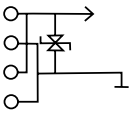
Terminals	Signal	Meaning	
J5-1	In 1a	Optical coupling inputs 1	**J5-1**
J5-2	In 1c		**J5-2**
J5-3	In 2a	Optical coupling inputs 2	**J5-3**
J5-4	In 2c		**J5-4**
J5-5	In 3a	Optical coupling inputs 3	**J5-5**
J5-6	In 3c		**J5-6**



Technical data Optical coupling inputs	MTT-S3	MTT-F52-S3	MTT6000-F51-S3
Number	3, galvanically isolated		
Voltage level „High“	min. 2.4 V; max. 30.0 V		
Voltage level „Low“	min. 0.0 V; max. 0.2 V		

Terminal block J6:

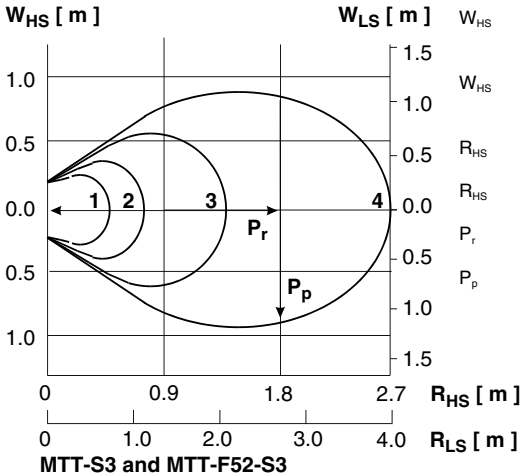
Terminals	Signal	Meaning	
J6-1	Spl 1	Supply voltage +	**J6-1**
J6-2	Rtnspl 1	Supply voltage -	**J6-2**
J6-3	Spl 2	Supply voltage +	**J6-3**
J6-4	Rtnspl 2	Supply voltage	**J6-4**



Technical data supply voltage	MTT-S3	MTT-F52-S3	MTT6000-F51-S3
Supply voltage DC	20 V ... 28 V, switchable 10 V ... 14 V	20 V ... 28 V, switchable 10 V ... 14 V	20 V ... 28 V, switchable 10 V ... 14 V
Current consumpt. at 24 V DC	150 mA	150 mA	150 mA
Current consumpt. at 12 V DC	500 mA	500 mA	500 mA

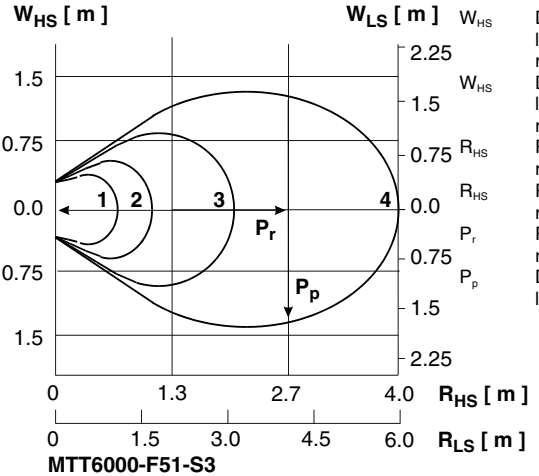
Date of Issue 11.07.2002

MTT-S3 and MTT-F52-S3 read ranges



MTT-S3 and MTT-F52-S3

MTT6000-F51-S3 read ranges



MTT6000-F51-S3

Date of Issue 11.07.2002

Date of Issue 11.07.2002

11 Appendix

Character table

The following table contains the Microsoft Windows standard character set, where characters 0 ... 127 are identical to the ASCII character set. Characters above 127 may differ for other operating systems.

Dec	Hex	Bin	Char	Ctrl		Dec	Hex	Bin	Char	Ctrl
0	00	0000 0000	Ctrl-@	NUL		33	21	0010 0001	!	
1	01	0000 0001	Ctrl-A	SOH		34	22	0010 0010	"	
2	02	0000 0010	Ctrl-B	STX		35	23	0010 0011	#	
3	03	0000 0011	Ctrl-C	ETX		36	24	0010 0100	$	
4	04	0000 0100	Ctrl-D	EOT		37	25	0010 0101	%	
5	05	0000 0101	Ctrl-E	ENQ		38	26	0010 0110	&	
6	06	0000 0110	Ctrl-F	ACK		39	27	0010 0111	’	
7	07	0000 0111	Ctrl-G	BEL		40	28	0010 1000	(	
8	08	0000 1000	Ctrl-H	BS		41	29	0010 1001	)	
9	09	0000 1001	Ctrl-I	HT		42	A2	0010 1010	*	
10	A0	0000 1010	Ctrl-J	LF		43	B2	0010 1011	+	
11	0b	0000 1011	Ctrl-K	VT		44	2C	0010 1100	,	
12	0C	0000 1100	Ctrl-L	FF		45	2d	0010 1101	-	
13	0d	0000 1101	Ctrl-M	CR		46	2E	0010 1110	.	
14	0E	0000 1110	Ctrl-N	SO		47	2F	0010 1111	/	
15	0F	0000 1111	Ct rl -O	SI		48	30	0011 0000	0	
16	10	0001 0000	Ctrl-P	DLE		49	31	0011 0001	1	
17	11	0001 0001	Ctrl-Q	DC1		50	32	0011 0010	2	
18	12	0001 0010	Ctrl-R	DC2		51	33	0011 0011	3	
19	13	0001 0011	Ctrl-S	DC3		52	34	0011 0100	4	
20	14	0001 0100	Ctrl-T	DC4		53	35	0011 0101	5	
21	15	0001 0101	Ctrl-U	NAK		54	36	0011 0110	6	
22	16	0001 0110	Ctrl-V	SYN		55	37	0011 0111	7	
23	17	0001 0111	Ctrl-W	ETB		56	38	0011 1000	8	
24	18	0001 1000	Ctrl-X	CAN		57	39	0011 1001	9	
25	19	0001 1001	Ctrl-Y	EM		58	A3	0011 1010	:	
26	A1	0001 1010	Ctrl-Z	SUB		59	B3	0011 1011	;	
27	B1	0001 1011	Ctrl-[	ESC		60	3C	0011 1100	<	
28	1C	0001 1100	Ctrl-\	FS		61	3d	0011 1101	=	
29	1d	0001 1101	Ctrl-]	GS		62	3E	0011 1110	>	
30	1E	0001 1110	Ctrl-^	RS		63	3F	0011 1111	?	
31	1F	0001 1111	Ct rl -/	US		64	40	0100 0000	@	
32	20	0010 0000		SP		65	41	0100 0001	A	
66	42	0100 0010	B			105	69	0110 1001	i	

Date of Issue 11.07.2002

Dec	Hex	Bin	Char	Ctrl
67	43	0100 0011	C	
68	44	0100 0100	D	
69	45	0100 0101	E	
70	46	0100 0110	F	
71	47	0100 0111	G	
72	48	0100 1000	H	
73	49	0100 1001	I	
74	A4	0100 1010	J	
75	B4	0100 1011	K	
76	4C	0100 1100	L	
77	4d	0100 1101	M	
78	4E	0100 1110	N	
79	4F	0100 1111	O	
80	50	0101 0000	P	
81	51	0101 0001	Q	
82	52	0101 0010	R	
83	53	0101 0011	S	
84	54	0101 0100	T	
85	55	0101 0101	U	
86	56	0101 0110	V	
87	57	0101 0111	W	
88	58	0101 1000	X	
89	59	0101 1001	Y	
90	A5	0101 1010	Z	
91	5b	0101 1011	[	
92	5C	0101 1100	\	
93	5d	0101 1101	]	
94	5E	0101 1110	^	
95	5F	0101 1111	_	
96	60	0110 0000	,	
97	61	0110 0001	a	
98	62	0110 0010	B	
99	63	0110 0011	c	
100	64	0110 0100	d	
101	65	0110 0101	E	
102	66	0110 0110	f	
103	67	0110 0111	g	
104	68	0110 1000	h	
144	90	1001 0000	_	

Dec	Hex	Bin	Char	Ctrl
106	A6	0110 1010	J	
107	6b	0110 1011	K	
108	6C	0110 1100	L	
109	6d	0110 1101	m	
110	6E	0110 1110	N	
111	6F	0110 1111	o	
112	70	0111 0000	p	
113	71	0111 0001	q	
114	72	0111 0010	R	
115	73	0111 0011	S	
116	74	0111 0100	T	
117	75	0111 0101	u	
118	76	0111 0110	v	
119	77	0111 0111	W	
120	78	0111 1000	x	
121	79	0111 1001	y	
122	A7	0111 1010	z	
123	7b	0111 1011	{	
124	7C	0111 1100 |		
125	7d	0111 1101	}	
126	7E	0111 1110	~	
127	7F	0111 1111	Ctrl-0	DEL
128	80	1000 0000	_	
129	81	1000 0001	_	
130	82	1000 0010	‚	
131	83	1000 0011	*ƒ*	
132	84	1000 0100	ì	
133	85	1000 0101	…	
134	86	1000 0110	†	
135	87	1000 0111	‡	
136	88	1000 1000	ˆ	
137	89	1000 1001	‰	
138	A8	1000 1010	Š	
139	8b	1000 1011	‹	
140	8C	1000 1100	OE	
141	8d	1000 1101	_	
142	8E	1000 1110	_	
143	8F	1000 1111	_	
183	7b	1011 0111	·	

Date of Issue 11.07.2002

Dec	Hex	Bin	Char	Ctrl	Dec	Hex	Bin	Char	Ctrl
145	91	1001 0001	ë		184	8b	1011 1000	¸	
146	92	1001 0010	í		185	9b	1011 1001	¹	
147	93	1001 0011	î		186	BA	1011 1010	º	
148	94	1001 0100	”		187	BB	1011 1011	»	
149	95	1001 0101	ï		188	BC	1011 1100	¼	
150	96	1001 0110	ñ		189	BD	1011 1101	½	
151	97	1001 0111	ó		190	BE	1011 1110	¾	
152	98	1001 1000	˜		191	BF	1011 1111	¿	
153	99	1001 1001	™		192	C0	1100 0000	À	
154	A9	1001 1010	š		193	C1	1100 0001	Á	
155	9b	1001 1011	›		194	C2	1100 0010	Â	
156	9C	1001 1100	oe		195	C3	1100 0011	Ã	
157	9d	1001 1101	_		196	C4	1100 0100	Ä	
158	9E	1001 1110	_		197	C5	1100 0101	Å	
159	9F	1001 1111	Ÿ		198	C6	1100 0110	Æ	
160	A0	1010 0000			199	C7	1100 0111	Ç	
161	A1	1010 0001	¡		200	C8	1100 1000	È	
162	A2	1010 0010	¢		201	C9	1100 1001	É	
163	A3	1010 0011	£		202	CA	1100 1010	Ê	
164	A4	1010 0100	¤		203	CB	1100 1011	Ë	
165	A5	1010 0101	¥		204	CC	1100 1100	Ì	
166	A6	1010 0110	¦		205	CD	1100 1101	Í	
167	A7	1010 0111	§		206	CE	1100 1110	Î	
168	A8	1010 1000	¨		207	CF	1100 1111	Ï	
169	A9	1010 1001	©		208	0d	1101 0000	Ð	
170	AA	1010 1010	ª		209	1d	1101 0001	Ñ	
171	AB	1010 1011	«		210	2d	1101 0010	Ò	
172	AC	1010 1100	¬		211	3d	1101 0011	Ó	
173	AD	1010 1101	-		212	4d	1101 0100	Ô	
174	AE	1010 1110	®		213	5d	1101 0101	Õ	
175	AF	1010 1111	¯		214	6d	1101 0110	Ö	
176	0b	1011 0000	°		215	7d	1101 0111	×	
177	B1	1011 0001	±		216	8d	1101 1000	Ø	
178	B2	1011 0010	²		217	9d	1101 1001	Ù	
179	B3	1011 0011	³		218	DA	1101 1010	Ú	
180	B4	1011 0100	´		219	DB	1101 1011	Û	
181	5b	1011 0101	µ		220	DC	1101 1100	Ü	
182	6b	1011 0110	¶		221	DD	1101 1101	Ý	
222	DE	1101 1110	Þ		239	EF	1110 1111	ï	

Date of Issue 11.07.2002

Dec	Hex	Bin	Char	Ctrl	Dec	Hex	Bin	Char	Ctrl
223	DF	1101 1111	ß		240	F0	1111 0000	ð	
224	E0	1110 0000	à		241	F1	1111 0001	ñ	
225	E1	1110 0001	á		242	F2	1111 0010	ò	
226	E2	1110 0010	â		243	F3	1111 0011	ó	
227	E3	1110 0011	ã		244	F4	1111 0100	ô	
228	E4	1110 0100	ä		245	F5	1111 0101	õ	
229	E5	1110 0101	å		246	F6	1111 0110	ö	
230	E6	1110 0110	æ		247	F7	1111 0111	÷	
231	E7	1110 0111	ç		248	F8	1111 1000	ø	
232	E8	1110 1000	è		249	F9	1111 1001	ù	
233	E9	1110 1001	é		250	FA	1111 1010	ú	
234	EA	1110 1010	ê		251	FB	1111 1011	û	
235	EB	1110 1011	ë		252	FC	1111 1100	ü	
236	EC	1110 1100	ì		253	FD	1111 1101	ý	
237	ED	1110 1101	í		254	FE	1111 1110	þ	
238	EE	1110 1110	î		255	FF	1111 1111	ÿ	

Date of Issue 11.07.2002

One Company, Two Divisions.

Factory Automation Division

Product Range

- Digital and analogue sensors
- in different technologies
  - Inductive and capacitive sensors
  - Magnetic sensors
  - Ultrasonic sensors
  - Photoelectric sensors
- Incremental and absolute rotary encoders
- Counters and control equipment
- Identification Systems
- AS-Interface

Areas of Application

- Machine engineering
- Conveyor or transport
- Packaging and bottling
- Automotive industry

Process Automation Division

Product Range

- Signal conditioners
- Intrinsically safe interface modules
- Remote Process Interface (RPI)
- Intrinsically safe field bus solutions
- Level control sensors
- Process measuring and control systems engineering at the interface level
- Intrinsic safety training

Areas of Application

- Chemical industry
- Industrial and community sewage
- Oil, gas and petrochemical industry
- PLC and process control systems
- Engineering companies for process systems

Service Area

Worldwide sales, customer service and consultation via competent and reliable Pepperl+Fuchs associates ensure that you can contact us wherever or whenever you need us. We have subsidiaries worldwide for your convenience.

http://www.pepperl-fuchs.com

USA Headquarters
Pepperl+Fuchs Inc. · 1600 Enterprise Parkway
Twinsburg, Ohio 44087 · Cleveland-USA
Tel. (330) 4 25 35 55 · Fax (330) 4 25 46 07
e-mail: sales@us.pepperl-fuchs.com

Worldwide Headquarters
Pepperl+Fuchs GmbH · Königsberger Allee 87
68307 Mannheim · Germany
Tel. +49 621 7 76-0 · Fax +49 621 7 76-10 00
e-mail: fa-info@de.pepperl-fuchs.com

Asia Pacific Headquarters
Pepperl+Fuchs Pte Ltd. · P+F Building
18 Ayer Rajah Crescent · Singapore 139942
Tel. 67 79 90 91 · Fax 68 73 16 37
e-mail: sales@sg.pepperl-fuchs.com

PEPPERL+FUCHS