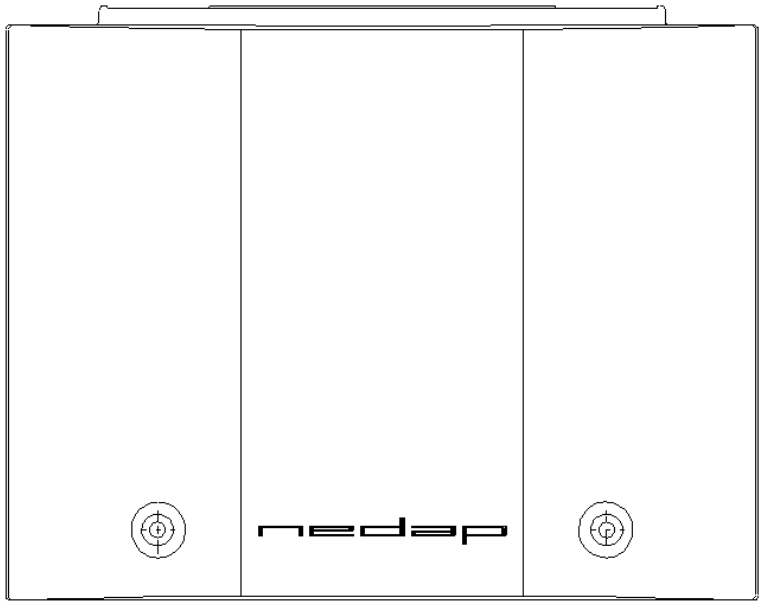


TRANSIT-USA

INSTALLATION GUIDE

(For Extended and PS-270 versions)

September 19, 2002 Part no : 9875220

Parallelweg 2E
P.O. Box 103
NL - 7140 AC Groenlo

FCC ID : CGD TRANSIT

The device complies with part 15 of the FCC rules. Operation is subject to the following conditions:

(1) This device may not cause harmful interference, and (2) this device must accept any interference that may cause undesired operation.

Contents

1 INTRODUCTION 4
1.1 Characteristics 4
1.2 Versions. 5
1.3 Safety precautions. 6
2 INSTALLATION 7
2.1 Installation. 7
2.2 Basic connections. 8
2.3 Transceiver unit DIP-switch settings and indications and adjustments. 11
2.4 PS-270 connections, U-link & DIP-switch settings and indications. 14
2.5 Optional NX-500 board, TRANSIT Extended only. 22
3 COMMUNICATION INTERFACES. 25
3.1 Connections to inductive readers. 25
3.2 Connections via the special code emulation outputs. 25
3.3 Removing the optional communication boards. 25
3.4 RS 232 (RS 232 III, Art. No.: 7806434) 26
3.5 RS 422 (CM-422, Art. No.: 7811730) 27
3.6 Universal thin server. (Art. No.: 7806434) 28
3.7 Profibus DP (Art. No: 7817134) 29
4 APPLICATION INFORMATION 30
4.1 Available embedded software. 30
4.2 Coverage area 30
4.3 Speed limitations. 31
4.4 Using more systems at the same location. 31
4.5 Read range control TRANSIT-SUB. (Art. 7800150) 32
4.6 Typical situations 34
4.7 Typical configurations. 39

1 Introduction.

A high level of performance, security, reliability and convenience is required in various control and monitoring systems. TRANSIT® is a long-range automatic identification system. The TRANSIT® reader communicates with a broad range of tags in all environmental conditions.

TRANSIT® is based on proven microwave technology in the 2.45 GHz ISM band and allows identification of tags at a distance up to 10 meters, even at high speeding passage. The NEDAP TRANSIT® system features radio frequency identification equipment using modulated backscatter. In this method, the tags send there code to the reader by modulating and reflecting the signal transmitted by the reader. To reduce the influence of unwanted reflections, NEDAP applied circular polarization, which also allows orientation freedom of the tags.

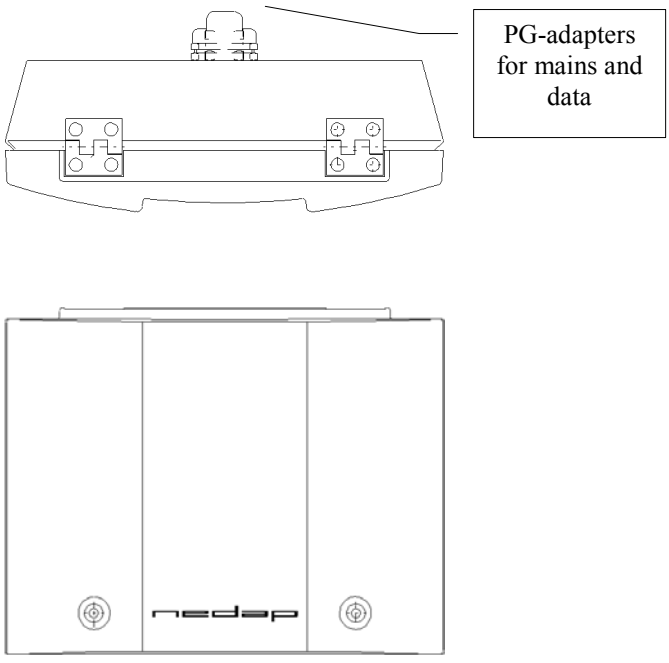
TRANSIT® combines microwave identification and inductive identification in one unit. The system has the possibility to identify vehicle and persons caring NEDAP XS-cards. For this purpose a small inductive antenna can be connected to the reader. (Reflex-130) The combination of the small inductive antenna with TRANSIT® is called the Gate-Master function. Special firmware will be needed see par 3.1

TRANSIT® system has a wide range of tags for various applications. Lithium batteries energize the tag circuit, which gives lifetimes up to 10 years. Heavy-duty tag is developed for vehicle applications. The Window-tags can be mounted easily behind the windshield of a vehicle. The Booster-unit is a special Window-tag that can hold a NEDAP inductive identification card. The booster reads this card after activation by the driver. The information from the card is then transmitted to the microwave reader.

Combi-booster is a combination of the Window-tag and the Booster-unit, which makes the identification of driver and vehicle possible. Pocket-tag is a microwave tag intended for the identification of people on large distances.

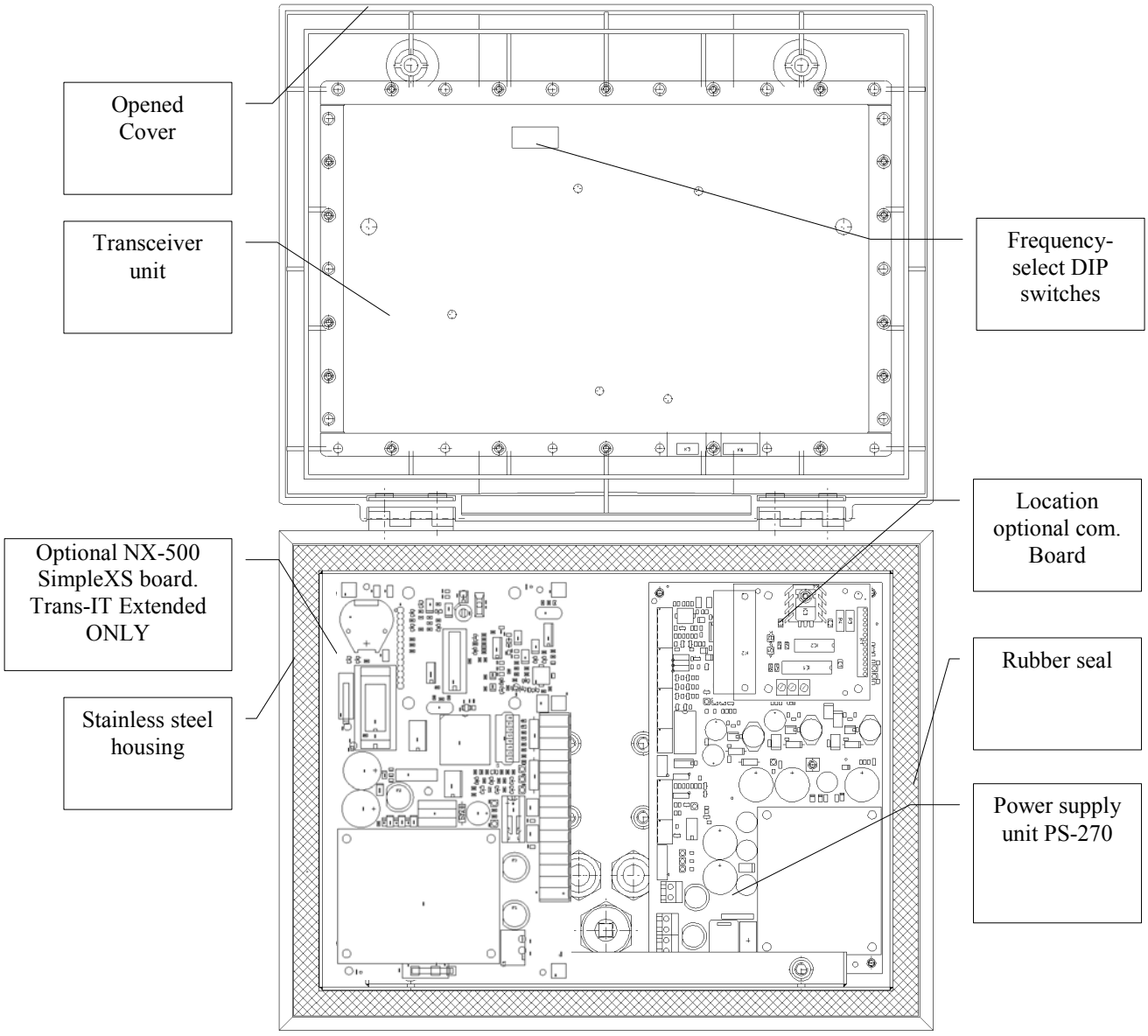
1.1 Characteristics.

The TRANSIT® consists out of stainless steel housing, covered by a synthetic material cover. Removing the two snake eye screws in the cover using a special tool can open this cover. After opening the unit the major components of the system are becoming visible. In the cover the Transceiver-unit is located, on the bottom of the stainless steel housing the Power-supply-unit is located. On the Power-supply-unit one of the optional communication boards can be placed. The backside of the unit hosts three PG-adapters respectively two PG-9, to be used for data communication cables, and one PG-13 adapter to be used for Mains connections.



1.2 Versions.

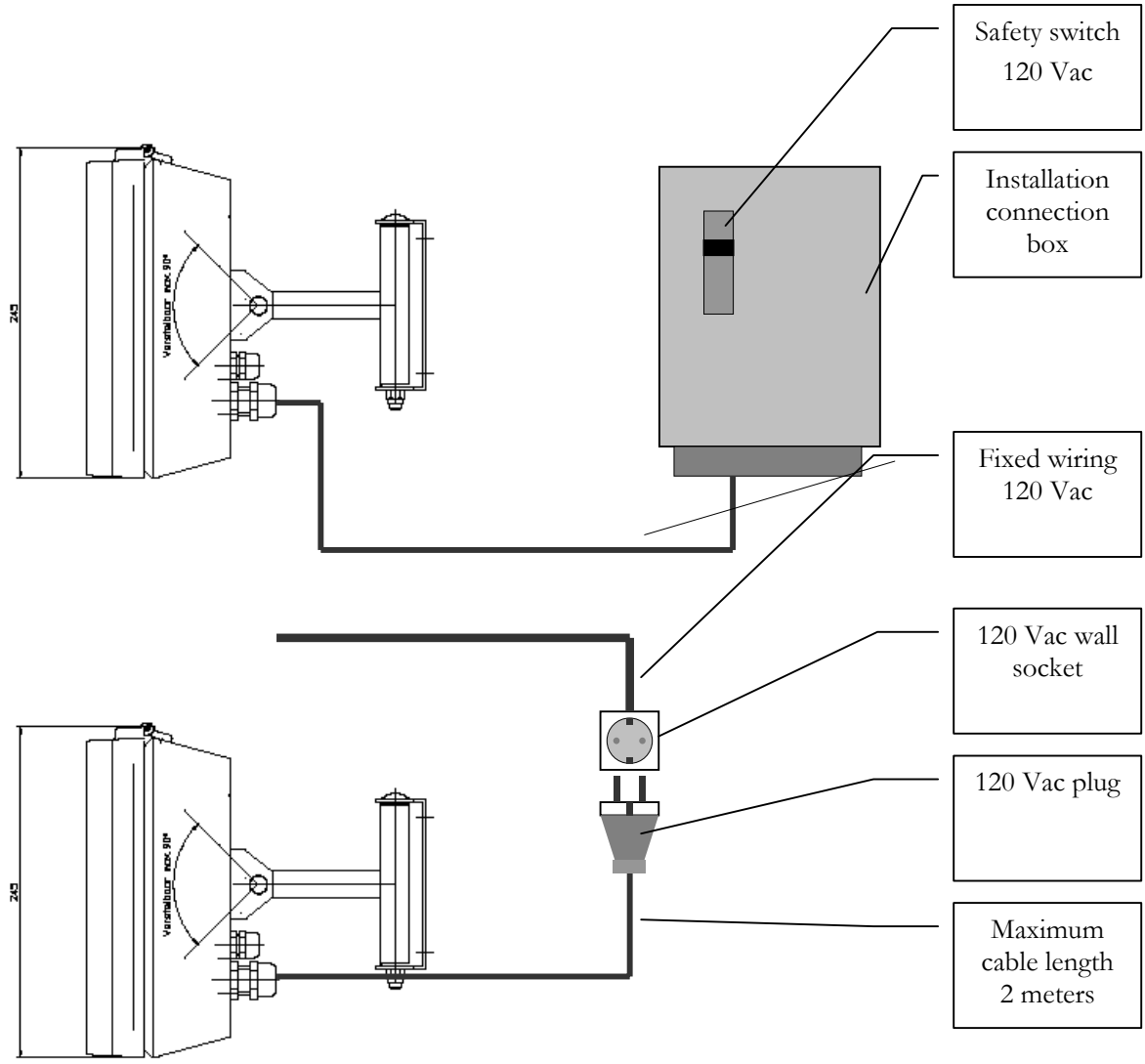
Version	Description	Article number.
TRANSIT 120 Vac USA PS-270	Special version with PS-270 for parking systems	9875220
TRANSIT 120 Vac USA Extended PS-270	Extended version of TRANSIT for access control systems and parking systems.	t.b.d.



1.3 Safety precautions.

The following safety precautions shall be observed during normal use, service and repair.

- The TRANSIT shall be connected to safety ground.
- Disconnecting from main power supply before removing any parts.
- The TRANSIT shall only be installed and serviced by qualified personnel
- To be sure of safety, do not modify or add anything other than mentioned in this manual or indicated by NEDAP NV.
- Replace fuses only with the same type and rating.
- Connecting the TRANSIT to the 120 Vac mains shall be in accordance with one of the two options shown in the figures below.
- The safety switch shall be a two-pole switch, disconnecting the line and neutral, with a contact distance of at least 3-mm.



2 INSTALLATION

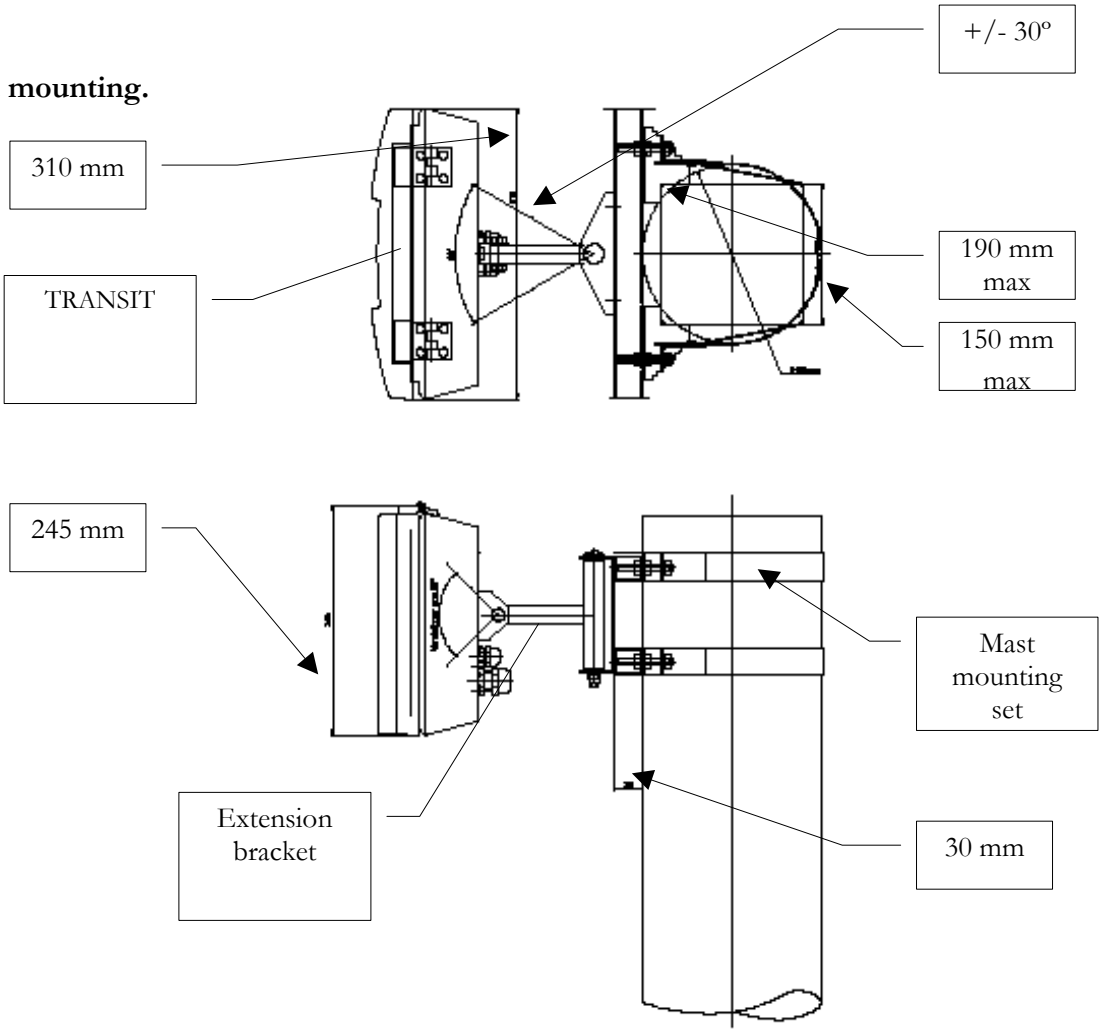
2.1 Installation.

The TRANSIT reader can be installed in any position. Normally the reader shall be mounted in a horizontal position, then the coverage area in the horizontal plane is maximized. In some applications a vertical installation is required to make use of the smaller beam width in the vertical plane. The mounting brackets which make rotation in the vertical and horizontal plane possible is standard included in every TRANSIT.

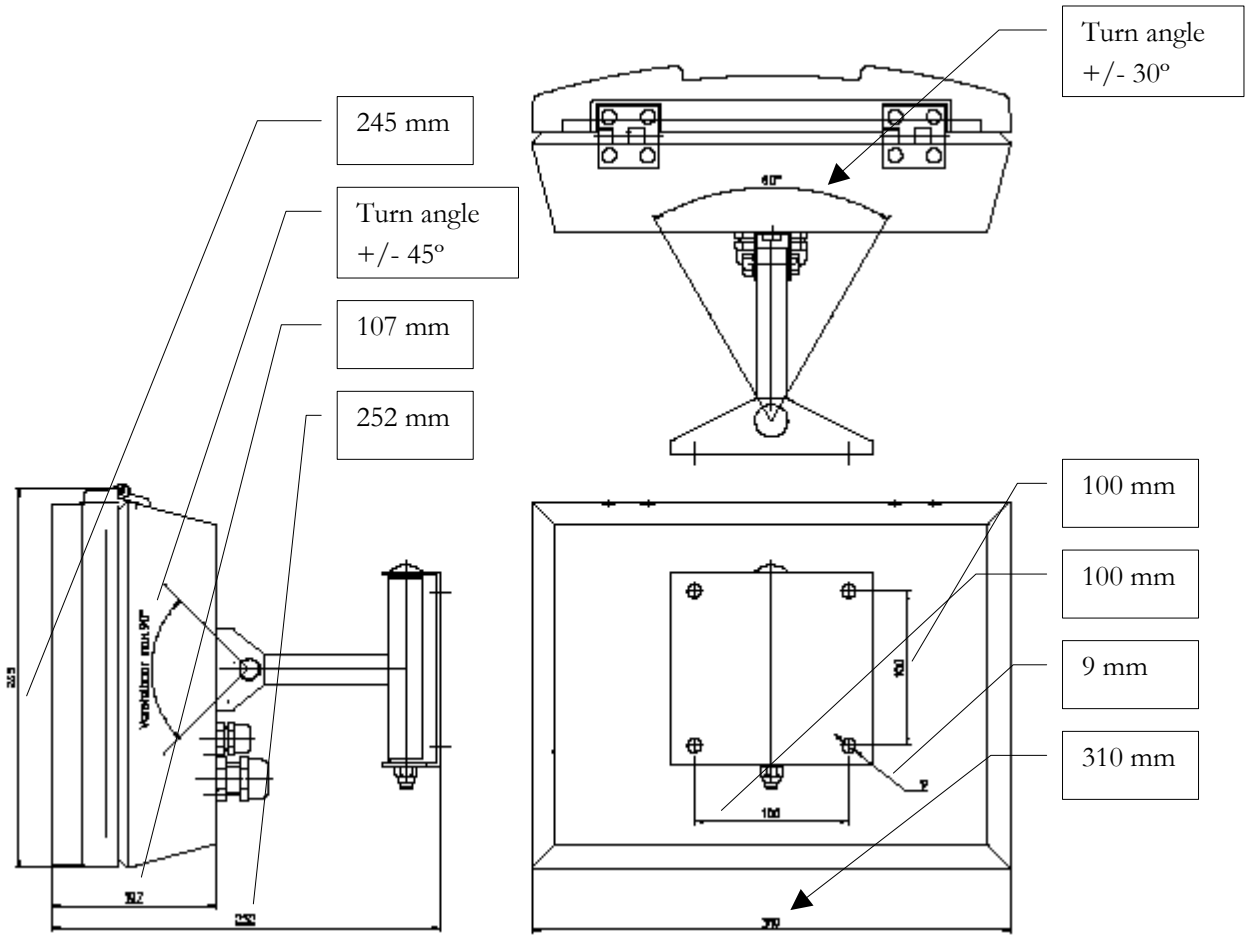
The following mast mounting part is available for the TRANSIT.

Part	Description	NEDAP article number
• **Mast mounting set**	Universal mast mounting set for square and round masts. Max. 150 mm square and max. 190 mm round	5626595

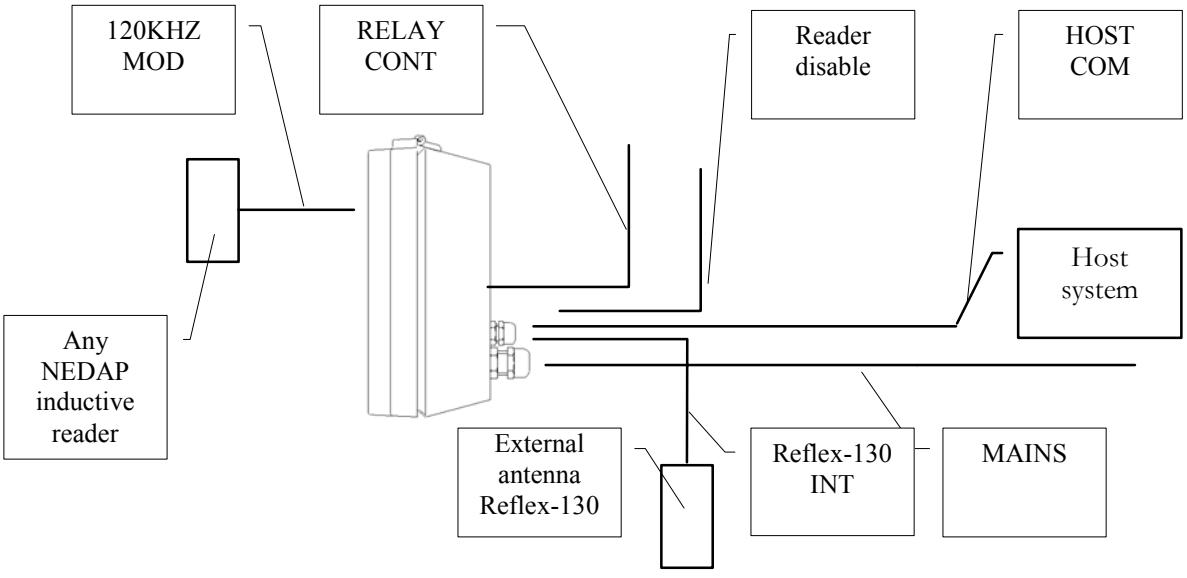
2.1.1 Mast mounting.



2.1.2 Wall mounting.



2.2 Basic connections.



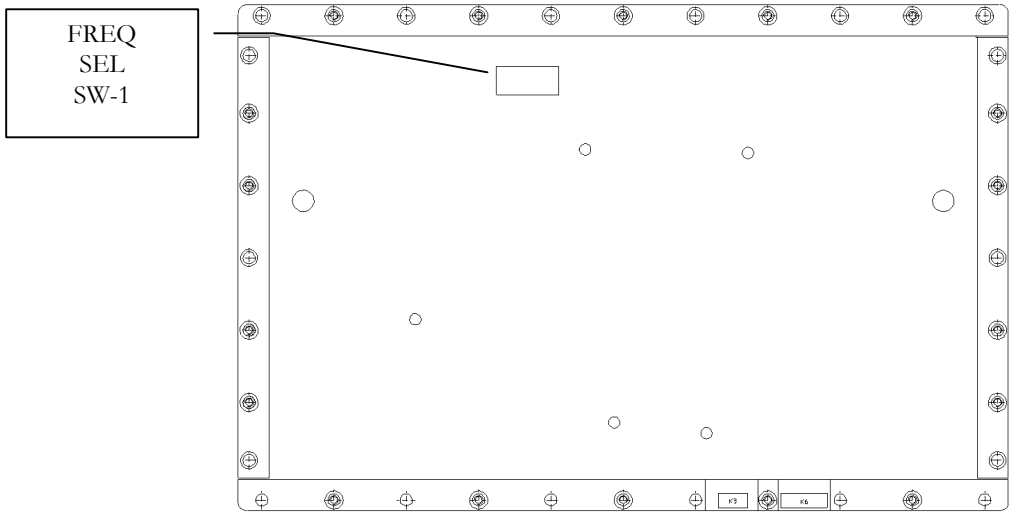
TRANSIT Basic connections	Cable type	Max length	Functional description	Signal names
MAINS				
• **MAINS-IN**	3 * 0.75 mm2	N/A.	System power supply. The safety ground shall be connected directly to the chassis.	120VAC-L 120 VAC-N Safety Ground
• **DC-SUPPLY**	2 * 1.5 mm2	N/A	System power supply.	+24VDC GND
RELAY CONT	3 * 0.75 mm2	25Vdc, 2 A 120Vac, 1A	Relay contacts normally open, center contact and normally closed.	COM NC NO
Reflex-130 INT	4 * 0.25 mm2 shielded	Maximum 15 meter	Connection to the external inductive antenna Reflex-130.	HF+ HF- UL GND NA
HOST-COM				
• **B-W-O-OUT**	4 * 0.25 mm2 shielded	Maximum 50 meter	Detected tag numbers are packed according the Bar-code-39, Wiegand-26 or Omron-7811-2 protocol. Selected by EEPROM	O-1 O-2 O-3 GND
• **RS 232-C**	3 * 0.25 mm2 shielded cable capacity <= 100 pF/meter	Maximum 15 meter	When STANDARD communication board is placed.	TX GND RX
• **RS-422**	4 * 0.25 mm2 shielded cable capacity <= 100 pF/meter	Maximum 1200 meter	When OPTIONAL communication board is placed.	TX- TX+ RX- RX+ GND

s

TRANSIT Basic connections	Cable type	Max length	Functional description	Signal names
Reader disable	2 * 0.25 mm2 shielded	Maximum 15 meter	Use always a relay contact to connect the internal 5 Vdc to the Reader disable input. **Using an external 5 Vdc voltage can damage the unit**	Rdis 5V
120KHZ MOD	Coax RG58U	Maximum 100 meter	Connects any external NEDAP inductive reader to the TRANSIT. The TRANSIT shall modulate the received tag data on the 120 kHz signal from the inductive reader. By doing this it looks as if the TRANSIT is an inductive antenna for the external inductive reader.	HF+ HF-

2.3 Transceiver unit DIP-switch settings and indications and adjustments.

2.3.1 DIP switch settings.

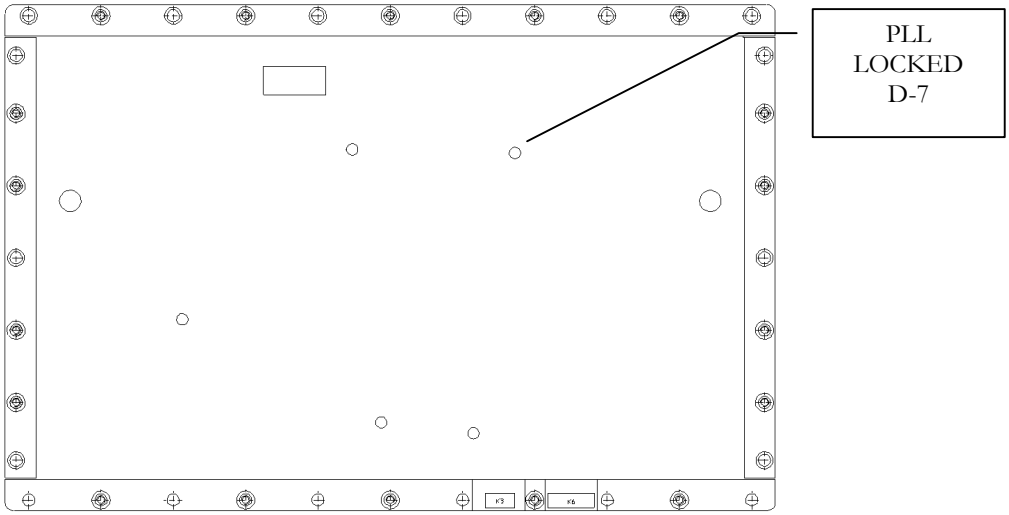


DIP-switch Transceiver unit	Switch type	Function	Description	Switch number
• SW-1	5 bit dip switch	Frequency selection.	Channels select within sub band.	S-1
			Channels select within sub band.	S-2
		LSB changes results in 600 kHz frequency changes.	Channels select within sub band.	S-3
			Channels select within sub band.	S-4
			Sub band selection.	S-5

Frequency selection table.

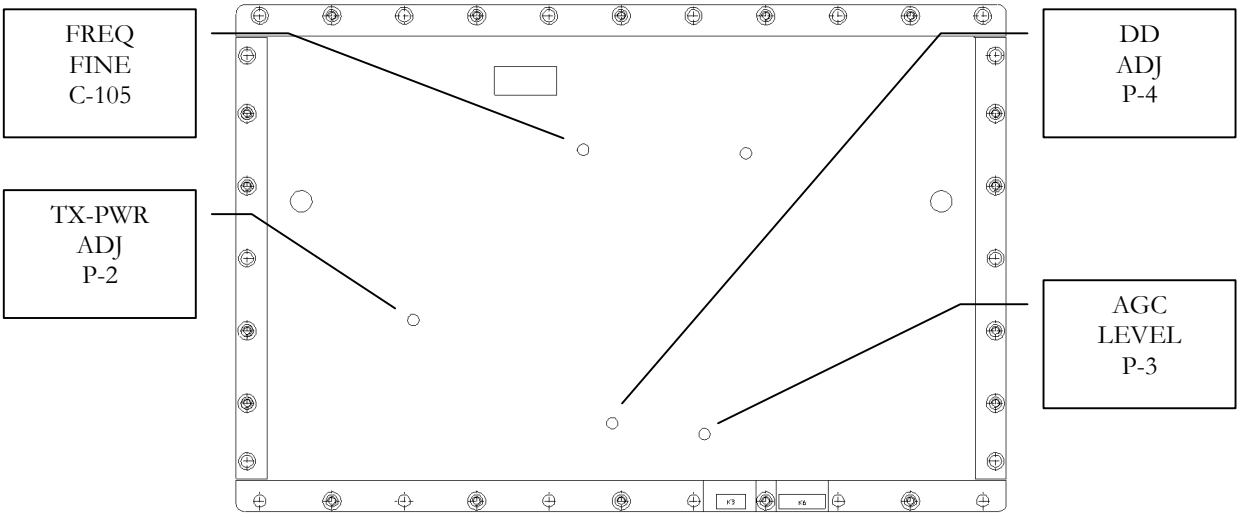
SUBBAND 5	S-5				SUBBAND 6	S-5			
SW1	1				SW1	0			
Frequency kHz	S-1	S-2	S-3	S-4	Frequency kHz	S-1	S-2	S-3	S-4
2.438.400	1	1	1	1	2.448.000	1	1	1	1
2.439.000	0	1	1	1	2.448.600	0	1	1	1
2.439.600	1	0	1	1	2.449.200	1	0	1	1
2.440.200	0	0	1	1	2.449.800	0	0	1	1
2.440.800	1	1	0	1	2.450.400	1	1	0	1
2.441.400	0	1	0	1	2.451.000	0	1	0	1
2.442.000	1	0	0	1	2.451.600	1	0	0	1
2.442.600	0	0	0	1	2.452.200	0	0	0	1
2.443.200	1	1	1	0	2.452.800	1	1	1	0
2.443.800	0	1	1	0	2.453.400	0	1	1	0
2.444.400	1	0	1	0	2.454.000	1	0	1	0
2.445.000	0	0	1	0	2.454.600	0	0	1	0
2.445.600	1	1	0	0	2.455.200	1	1	0	0
2.446.200	0	1	0	0	2.455.800	0	1	0	0
2.446.800	1	0	0	0	2.456.400	1	0	0	0
2.447.400	0	0	0	0	2.457.000	0	0	0	0

2.3.2 Transceiver unit indications.



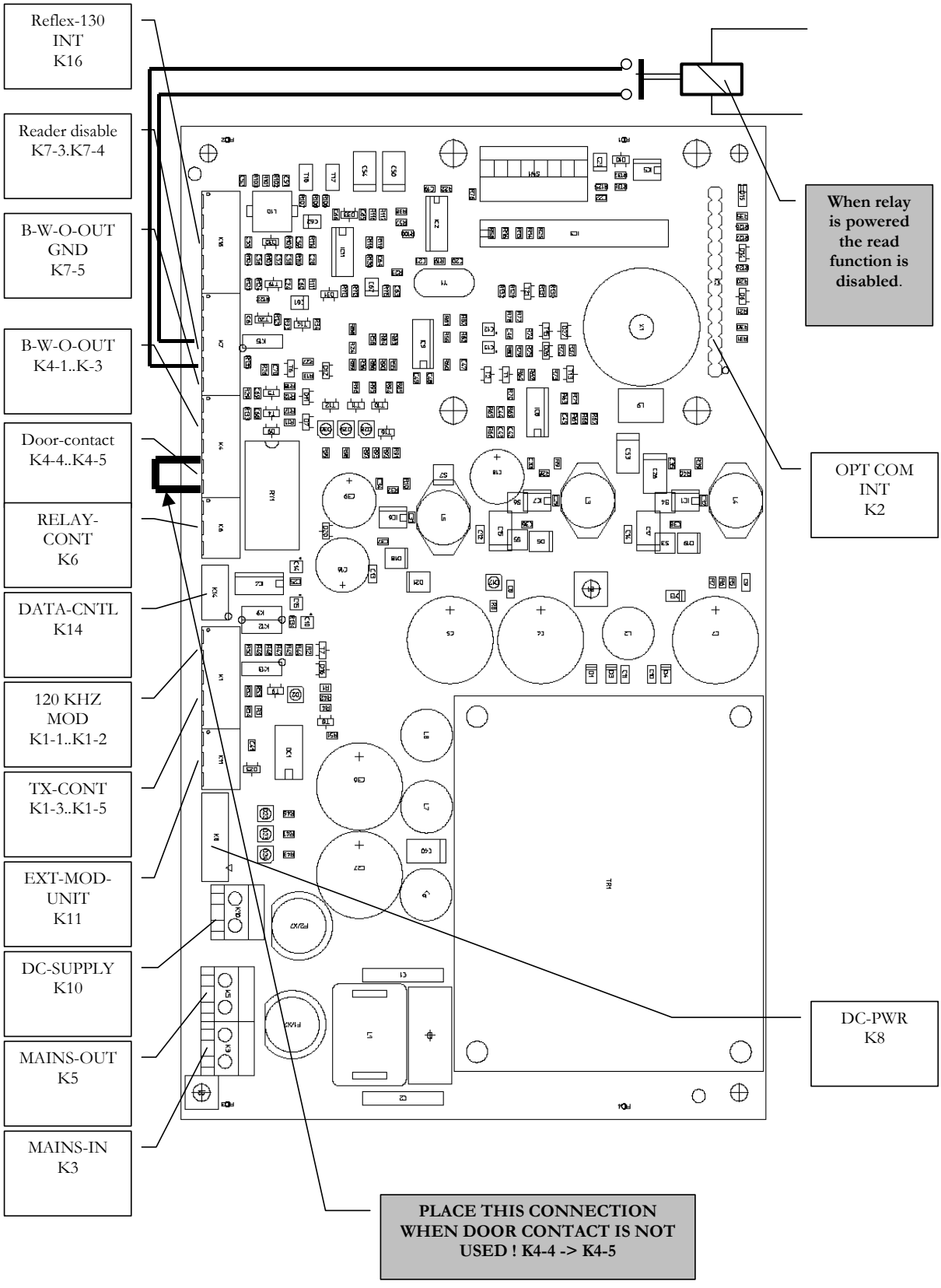
Indications Transceiver unit	Indication type	Description	Indication number
• **PLL LOCKED**	Dual color LED	Red indicates PLL is unlocked. Green indicates PLL is locked.	D-7

2.3.3 Transceiver unit adjustments.



Adjustments Transceiver unit	Adjustment type	Function	Description	Adjustment number
• **FREQ - FINE**	Trim cap.	Factory setting	Fine tuning reference frequency for synthesizer.	C-105
• **TX-PWR**	Trim pot.	Customer setting	Reduction transmitter power by maximum 20 dB. Maximum EIRP < 18 dBm .	P-2
• **DD-ADJ**	Trim pot.	Factory setting	Received data duty cycle correction.	P-4
• **AGC-LEVEL**	Trim pot.	Factory setting	AGC reference level adjustment.	P-3

2.4 PS-270 connections, U-link & DIP-switch settings and indications.



2.4.1 PS-270 connections.

PS-270 connections	Connector type	Function	Description	Signal names	Pin number
• **Reflex-130 INT (K16)**	5-p mkds phoenix	External connection Reflex-130	120 kHz antenna con.	HF+	1
			120 kHz antenna con.	HF-	2
			LED cont. high pos. ID	UL	3
			Ground	GND	4
			LED cont. high neg. ID	NA	5
• **Reader disable (K7-1..K7-4)**	5-p mkds phoenix	Controls the flow of data to the controller.	Spare		1
			Spare		2
			Reader disable	R-dis	3
			+5 Vdc connection	5V	4
• **B-W-O-OUT (K7-5)**	5-p mkds phoenix	Code emulation.	Output for Omron, Wiegand and Barcode.	GND	5
• **B-W-O-OUT (K4-1..K4-3)**	5-p mkds phoenix	Code emulation.	Output for Omron, Wiegand and Barcode	O-1	1
				O-2	2
			Ground	O-3	3
• **Door contact (K4-4..K4-5)**	5-p mkds phoenix	Door contact	Door contact	Door	4
			Ground	GND	5
• **RELAY-CONT (K6)**	3-p mkds phoenix	Floating relay contacts	Center contact	COM	1
			Normally closed contact	NC	2
			Normally open contact	NO	3
• **DATA-CNTL (K14)**	6 wire flat cable PCB connector Micro Match	Internal connection to transceiver unit	Ground connection	GND	1
			Spare		2
			TTL received tag data	Det-data-out	3
			Received signal strength	U-AGC	4
			TTL signal PLL locked	Locked	5
			TTL signal enable TX	TX-enable	6
• **120 KHZ-MOD (K1-1..K1-2)**	2-p mkds phoenix	120 kHz input from external NEDAP inductive reader	120 kHz connection	HF+	1
			120 kHz ground con.	HF-	2

s

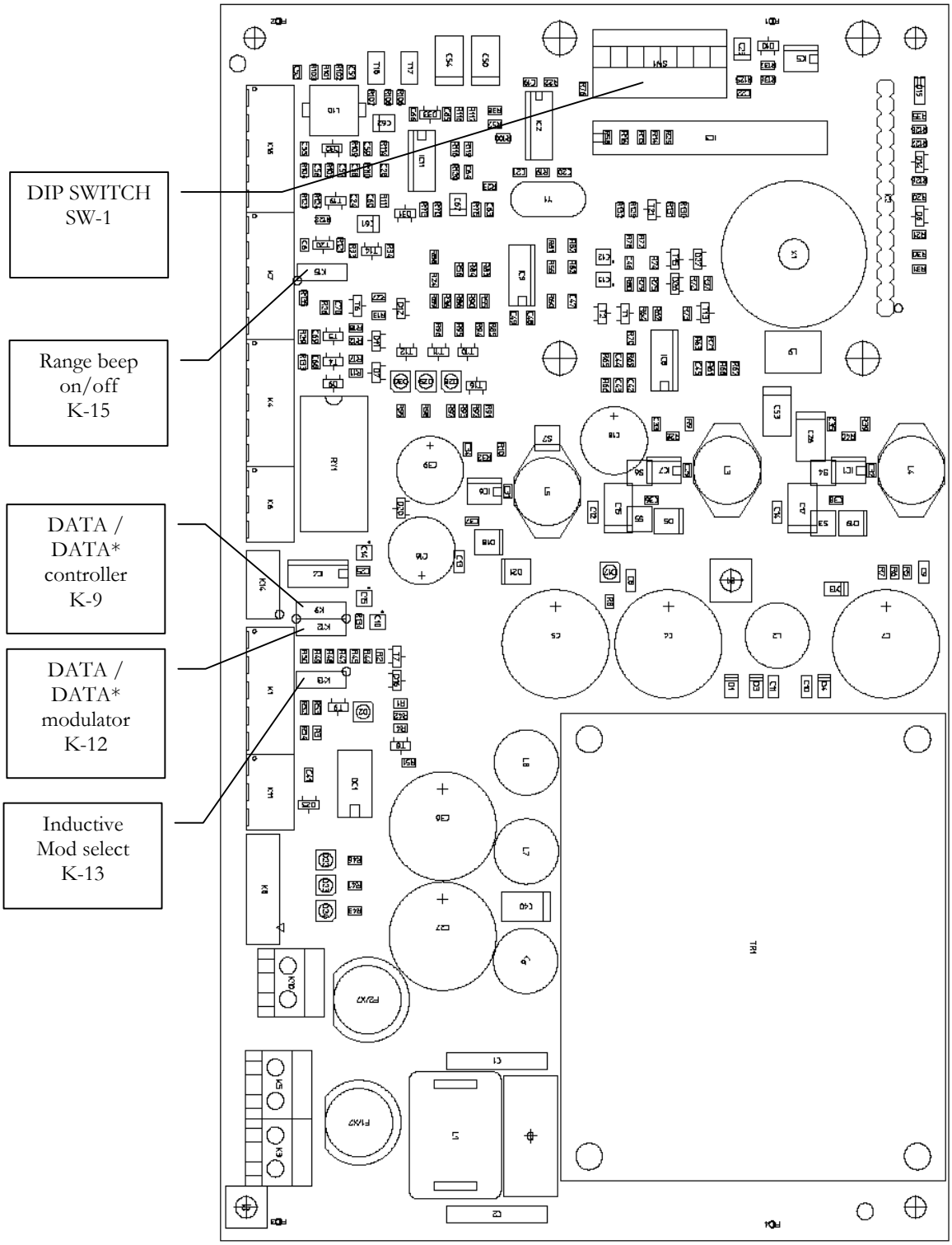
PS-270 connections	Connector type	Function	Description	Signal names	Pin number
• **TX-CONT (K1-3..K1-5)**	2-p mkds phoenix	Transmit-ter control	Ground for control sign.	GND	3
			TTL signal PPL locked	LCK	4
			TTL input to enable TX	TXD	5
• **EXT-MOD-UNIT (K11)**	3-p mkds phoenix	Connects received tag data to external reader	Isolated ground.	GND	1
			Optical isolated current loop connection.	CLS	2
			5 Vdc supply opto-coupler.	+5V	3
• **DC-SUPPLY (K10)**	2-p mkds phoenix	External DC power connection	External 24 Vdc input	+24Vdc	1
			External DC supply ground.	GND	2
• **MAINS-OUT (K5)**	2-p mkds phoenix	Internal connection to NX-500 optional board.	120 Vac output line.	120Vac	1
			120 Vac output neutral	120Vac	2
• **MAINS-IN (K3)**	2-p mkds phoenix	External AC power connection	120 Vac input line	120Vac	1
			120 Vac output neutral	120Vac	2
• **DC-PWR (K8)**	10 wire flat cable PCB connector Micro Match.	Internal connection to transceiver unit.	Ground connection.		1
			+15 Vdc connection		2
			+15 Vdc connection		3
			Ground connection.		4
			-15 Vdc connection		5
			-15 Vdc connection		6
			Ground connection.		7
			+ 5 Vdc connection		8
			+ 5 Vdc connection		9
			Ground connection.		10

rr

PS-270 connections	Connector type	Function	Description	Signal names	Pin number
• **OPT COM INT (K2)**	14 pen male connector 15.8 mm	Con-nection to optional communi-cation board.	Not connected.		1
			TTL TX-data com.	TX	2
			TTL RX-data com.	RX	3
			Ready to send	RTS	4
			Cleared to send.	CTS	5
			Ground	GND	6
			Ground	GND	7
			5 Vdc output	XV5P	8
			RS 485 I/O toggle signal.	I/O	9
			Not connected.		10
			Ground	GND	11
			24 Vdc output for com. board.	XV24P	12
			Not connected.		13
			Not connected		14

2.4.2 PS-270 U-Link & DIP-switch settings.

2.4.2.1 U-links.

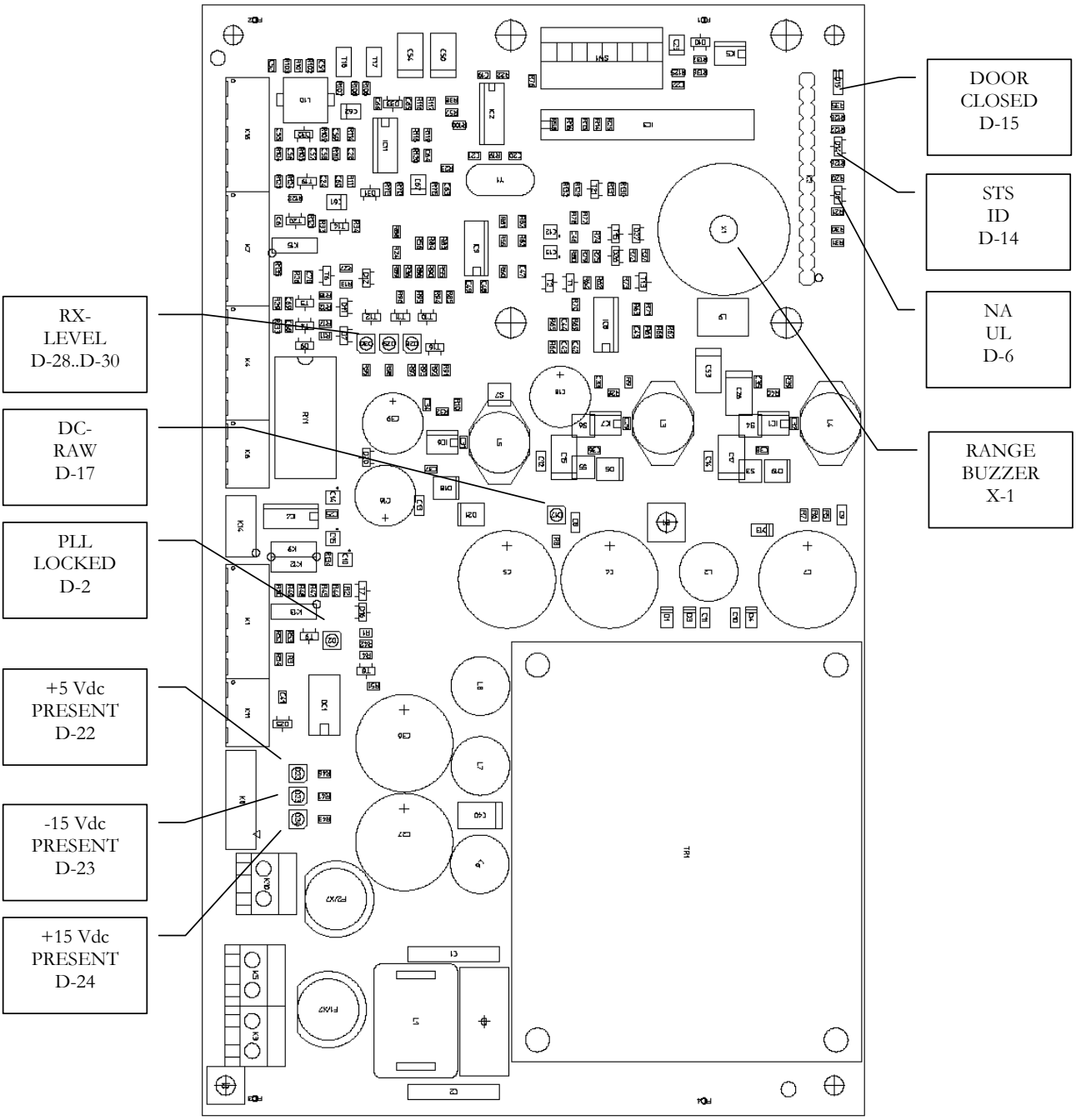


PS-270 U-link settings	U-link position	Description	U-link number
• **Invert microwave data**	**1**	Inverts uWave TTL data (default position)	**K-9**
	2	Inverts uWave TTL data.	
• **Range beep function**	**1**	Selects range beep function off. (default position)	**K-15**
	2	Selects range beep function on.	
• **Inverts inductive modulator data**	**1**	Inverts TTL data from uW-receiver and inductive-receiver to modulator. (default)	**K-12**
	2	Inverts TTL data from uW-receiver and inductive-receiver to modulator.	
• **Inductive Mod select**	**1**	Selects modulator setting for voltage coupled receivers.	**K-13**
	2	Selects modulator setting for current coupled receivers. (As is needed for the NX500 or SimpleXS) (default)	

2.4.2.2 DIP-switch SW-1 settings.

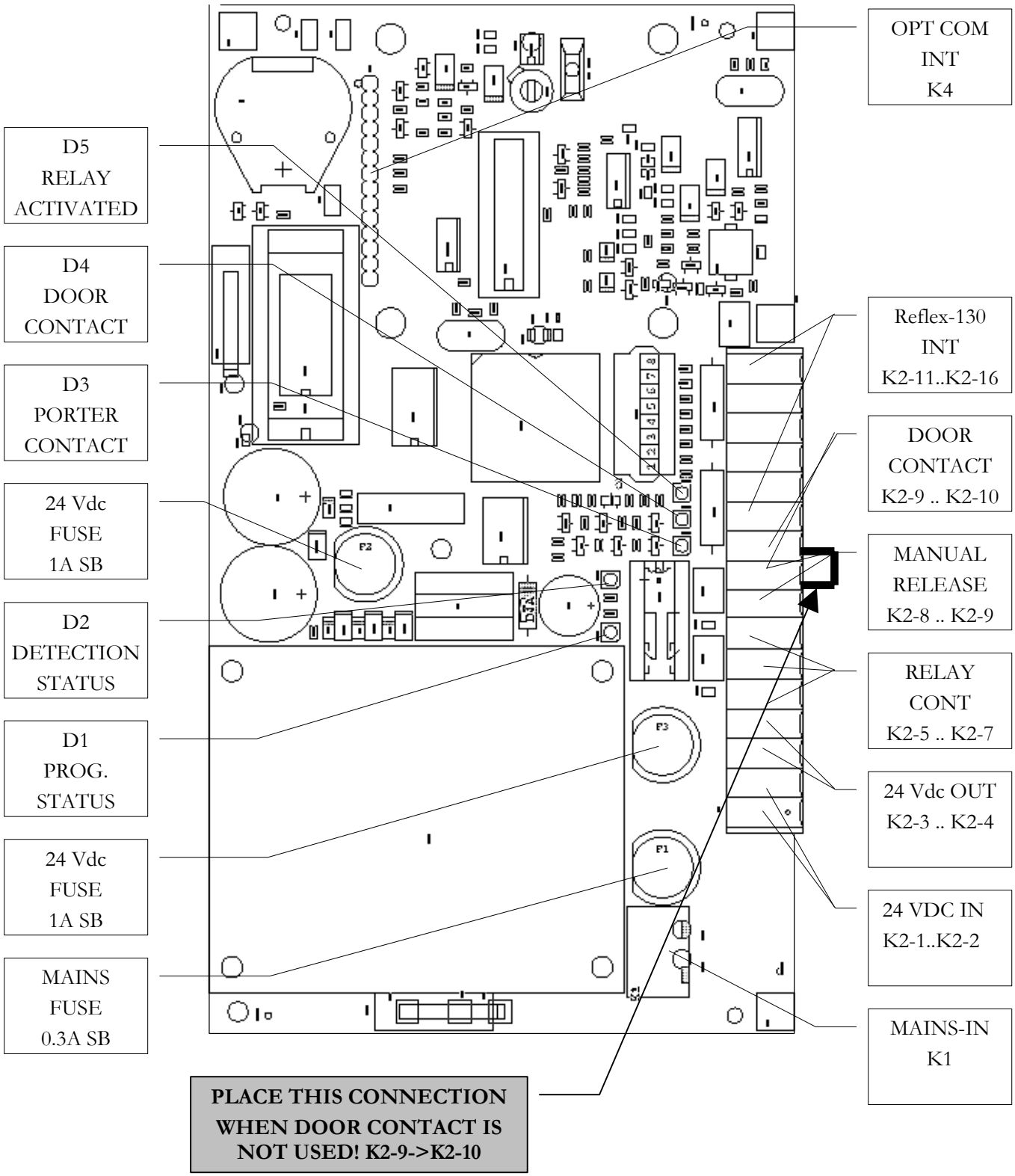
Refer for the DIP-switch settings to the manual of the loaded firmware.

2.4.3 PS-270 indications.



PS-270 Indications	Indication type	Description	Indication number
• **RX-LEVEL**	LED red	LED bar indicating the received tag signal strength.	**D-28..D-30**
• **DC-RAW**	LED green	LED active indicates that the DC supply is present.	**D-17**
• **PLL LOCKED**	LED green	LED active indicates PLL is locked.	**D-2**
• **+5 Vdc PRESENT**	LED green	LED active indicates that this voltage is present.	**D-22**
• **-15 Vdc PRESENT**	LED green	LED active indicates that this voltage is present.	**D-23**
• **+15 Vdc PRESENT**	LED green	LED active indicates that this voltage is present.	**D-24**
• **NA**	Dual color LED= red	LED indicates that the TRANSIT is standby and the door is locked	**D-6**
• **UL**	Dual color LED= green	LED indicates that a tag is detected, shall stay active during unlock time. The door is unlocked.	**D-6**
• **STS**	Dual color LED= red	LED indicates that processor is running by showing heartbeat (blinking).	**D-14**
• **ID**	Dual color LED= green	LED active during tag recognition (fast blinking).	**D-14**
• **DOOR CLOSED**	LED red	LED active indicates door contact closed.	**D-15**
• **RANGE BUZZER**	Sound	When activated by U-link K-15 and a valid tag is present the beep repeat frequency gives an indication for the received signal strength from the tag.	**X-1**

2.5 Optional NX-500 board, TRANSIT Extended only.



2.5.1 Connections.

NX-500 Connections	Cable type	Max length	Functional description	Pin number	Signal names
MAINS-IN (K1)	3 * 0.75 mm2	N/A.	System power-supply. The safety ground shall be connected directly to the chassis.	1 2	120VAC-L 120 VAC-N Safety Ground
24 VDC IN (K2-1 .. K2-2)	2 * 0.75 mm2	N/A	System emergency power-supply.	1 2	+24VDC GND
24 VDC OUT (K2-3 .. K2-4)	2 * 0.4 mm2	Maximum 100 meter	DC supply intended for lock control	3 4	+24VDC GND
RELAY CONT (K2-5 .. K2-7)	3 * 0.75 mm2	25Vdc, 2 A 120Vac, 1A	Relay contacts normally open, center contact and normally closed.	5 6 7	NC COM NO
MANUAL RELEASE (K2-8 .. K2-9)	2 * 0.25 mm2	Maximum 100 meter	Connect to push button to indicate manual door release.	8 9	PORT GND
DOOR CONTACT (K2-9 .. K2-10)	2 * 0.25 mm2	Maximum 100 meter	Connect to door contact To indicate door closed	9 10	GND DOOR
Reflex-130 INT (K2-11 .. K2-16)	5 * 0.25 mm2 shielded	Maximum 50 meter	Connection to the external inductive antenna Reflex-130.	11 12 13 14 15 16	HF+ GND UL GND NA IND

NX-500 Connections	Cable type	Max length	Functional description	Pin number	Signal names
OPT COM INT (K2)	14 pin male connector 15.8 mm.	Con-nection to optional communi-cation board.	Not connected.	1	
			TTL TX-data com.	2	TX
			TTL RX-data com.	3	RX
			Ready to send	4	RTS
			Cleared to send.	5	CTS
			Ground	6	GND
			Ground	7	GND
			5 Vdc output	8	XV5P
			RS 485 I/O toggle signal.	9	I/O
			Not connected.	10	
			Ground	11	GND
			24 Vdc output for com. board.	12	XV24P
			Not connected.	13	
			Not connected	14	

2.5.2 Indications.

NX-500 Indications	Indication type	Description	Indication number
PROG. STATUS	LED red	1 sec on / 1 sec off : Program is operational 1 short flash: Not enough RAM. 2 short flashes: RAM failure. 3 short flashes: EPROM failure	D-1
DETECTION STATUS	LED green	FLASH: Transponder/XS-card detected; authorized and not authorized.	D-2
PORTER CONTACT	LED green	Activated when manual door-release button activated.	D-3
DOOR CONTACT	LED green	Activated when door contact is closed.	D-4
RELAY ACTIVATED	LED green	Activated when relay is activated.	D-5

3 Communication interfaces.

3.1 Connections to inductive readers.

The TRANSIT features two ways to connect it to external inductive NEDAP readers.

- Bringing the 120 kHz antenna signal of the external inductive reader to the TRANSIT and connecting it to 120 kHz-MOD connector of the Power supply unit (K1-1 and K1-2). The TRANSIT will modulate the received tag data on the 120 kHz antenna signal of the external inductive reader. The TRANSIT looks for the external inductive reader as an antenna. This feature makes the application of the TRANSIT simple in existing installations. To optimize the quality of the modulating signal the modulation depth can be selected in accordance with the type of receiver used in the external inductive reader. The U-Link setting: " Inductive Mod select, K-13", on the Power supply unit allows for the selection between voltage- or current coupled receivers. Contact NEDAP when in doubt which kind of external inductive receiver you want to connect to the TRANSIT system.

- Remember that when using the modulation function of the TRANSIT on the 120 kHz antenna signal of an external inductive reader, to select external antenna (tuning) on this inductive reader. For the Accessor III-A and Accessor III-B for example this shall be realized by setting J1 in the external position.

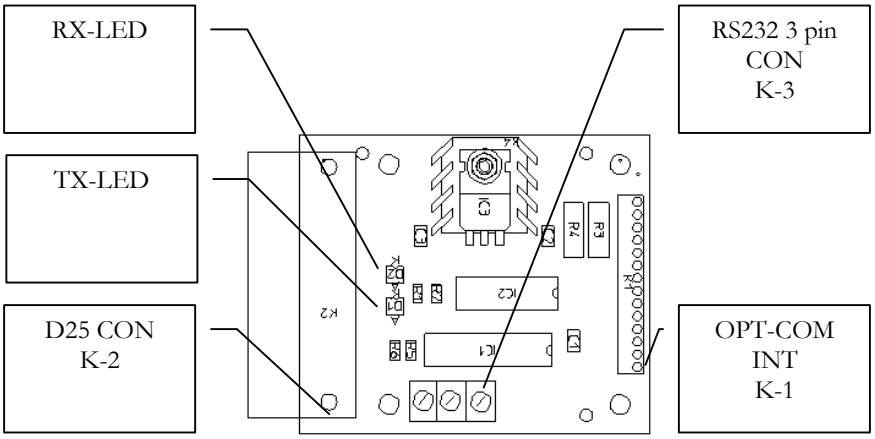
3.2 Connections via the special code emulation outputs.

- The outputs OUT-1, OUT-2 and OUT-3 used for the emulated output for Wiegand 26, Omron, Barcode and others are vulnerable for large potential differences. Care shall be taken to connect always the ground of the receiving system to the TransIT and use shielded cable.

3.3 Removing the optional communication boards.

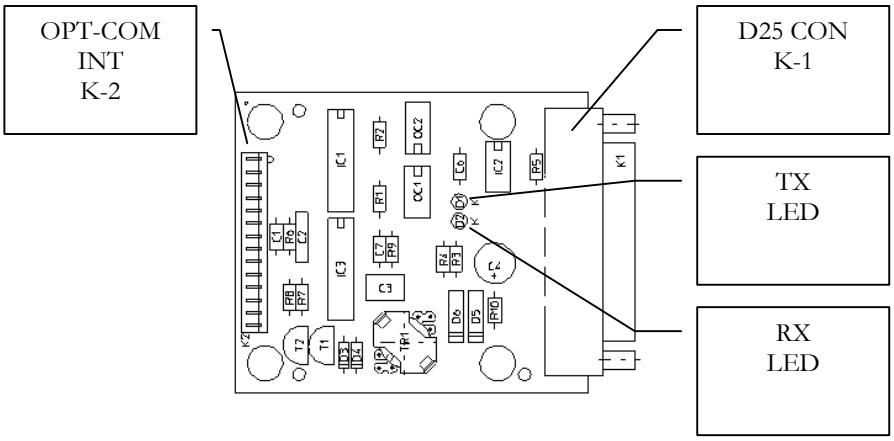
- Remove the optional communication boards only when the TransIT is disconnected from the mains supply, not doing this will damage the communication board.

3.4 RS 232 (RS 232 III, Art. No.: 7806434)



Internal interface RS 232 III	Connector type	Function	Description	Signal names	Pin number
• **OPT COM INT (K2)**	14 pen male connector 15.8 mm	Connec-tion to Power-supply unit.	See par 3.1.3.2	See par 3.1.3.2	See par 3.1.3.2
• **RS232 3 pin CON K-3**	3 pin WECO PCB	RS 232 connection	Transmit (output) Ground Receive (input)	Tx GND Rx	1 2 3
• **D25 CON K-2**	D25 connector female	RS 232 connection	Transmit (output) Receive (input) Do not connect. Do not connect Ground (shield) Identifier (max 100 mA) Do not connect	Tx Rx RTS CTS GND +5Vdc DTR	2 3 4 5 7 9 20

3.5 RS 422 (CM-422, Art. No.: 7811730)



- The CM 422 board has galvanic isolation.
- Maximum data rate 9600 baud.
- The LED's are indicating respectively that data is being transmitted (Tx) and data being received (Rx).
- The RX- and RX+ lines are always terminated with a 120 Ω resistor.
- The TX- and TX+ lines have to be terminated at the host side.
- Connection to host:
  - RX+ => TX- (host)
  - RX- => TX+ (host)
  - TX+ => RX- (host)
  - TX- => RX+ (host)

Internal interface CM 422	Connector type	Function	Description	Signal names	Pin number
• **OPT COM INT K-2**	14 pen male connector 15.8 mm	Connec-tion to Power supply unit.	See par 3.1.3.2	See par 3.1.3.2	See par 3.1.3.2
• **D 25 CON K-1**	D25 connector female	RS 422 connection	Receive* (input) Receive (input) Transmit* (output) Transmit (output)	RX- RX+ TX- TX+	15 17 19 25

3.6 Universal thin server. (Art. No.: 7806434)

The Universal Thin Server (UTS) is designed to connect NEDAP RF-ID devices with a serial interface to an Ethernet network using the TCP/IP protocol.

The Ethernet network interface speed is 10-Mbit.

3.6.1 LED Status Display

3.6.1.1 Yellow and Green LED

The green LED displays the status of the serial channel (the red LED will be off while in normal operation).

Stable color : Channel idle, no connection

Blinking, 1 sec cycle : Connected over the network

3.6.1.2 Red LED

If the red LED is on or blinking, the green LED will give a diagnostics code. There is a fatal error, and the UTS is not working.

Red LED stable on, green LED blinking:

1x: EPROM-checksum error

2x: RAM-error

3x: Network controller error (Token Ring)

4x: E²PROM checksum error or bad

5x: IP address already used on network

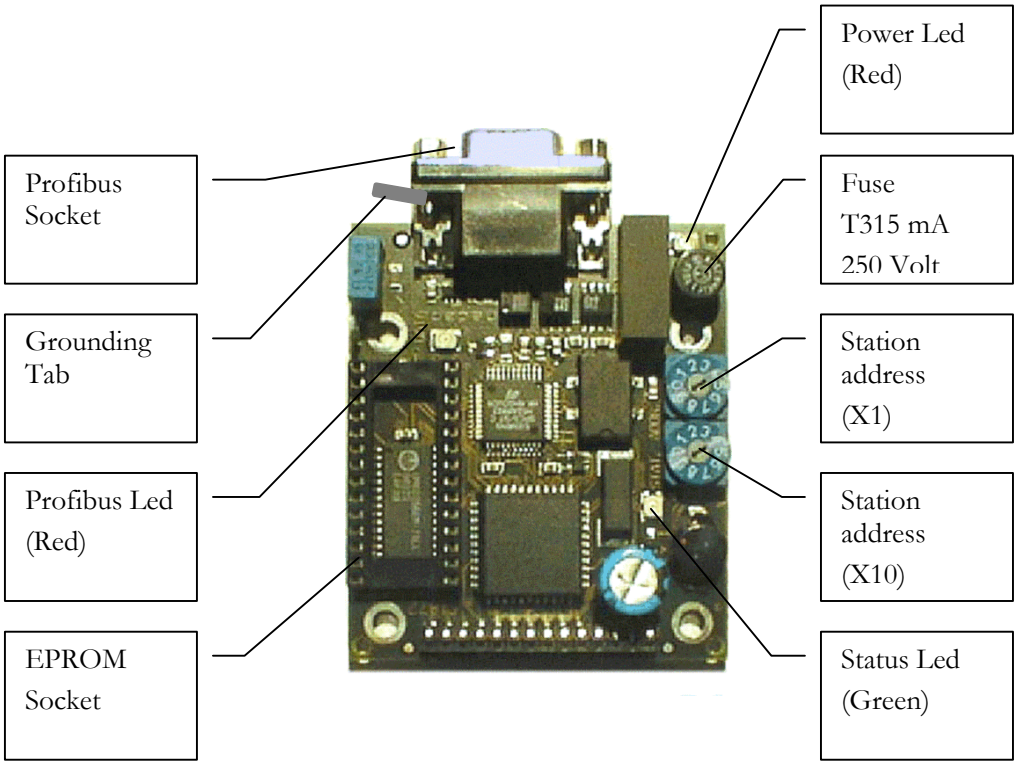
Red LED blinking, green LED blinking:

4x: The network connection is faulty. This code should only appear after power up. Even though the UTS is going into operation mode, the problem will potentially persist.

5x: No DHCP response was received.

See user manual Universal Thin Server for detailed information

3.7 Profibus DP (Art. No: 7817134)



Profibus Indications	Function	Description
• **Profibus socket**	Connection for Profibus Cable	Here the Profibus Cable must be connected
• **Station address X1 and X10**	Address setting	With these two rotation switches a station address from 0 –99 can be selected. Use switch X1 to select the units an x10 to select the tens. Addresses lower then 3 are mostly used by the Profibus master so it is recommended not to use the values 0 – 2.
• **Power LED**	Indication Red	This LED indicates that power is available. This LED should always be on as soon as power is turned on.
• **Status LED**	Indication Green	This LED indicates the status of the Profibus DP Interface Module and should always blink. The status is indicated by the on and off time of the LED. See manual for all possible status indications.
• **Profibus LED**	Indication Red	This LED will be on when the Profibus master recognizes the interface module. When this LED is off then this mostly indicates an error at the Profibus master
• **Grounding tab**	Earth connection	I connected to Profibus cable shield and must be connected to ground.
• **Fuse**	Overload protection	Protects the galvanic isolated Profibus circuit. Fuse is blown when Power LED is off and status LED is still blinking.
• **Eprom socket**		Here the Eprom with the embedded software will be inserted.

4 APPLICATION INFORMATION

4.1 Available embedded software.

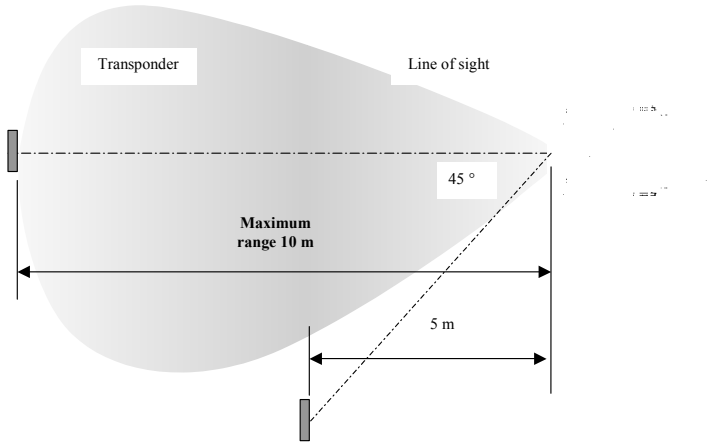
The TRANSIT communication features are defined by the firmware loaded in to the micro controller located on the Power supply unit PS-270. The micro controller is a Micro Chip PIC 16F876-20I / SP

(NEDAP Art. No.: 2802260).

For every firmware version an installation guide is available. The firmware can be loaded and upgraded in the PIC using a special software tool.

Contact Nedap for the possibilities.

4.2 Coverage area.



The TRANSIT system operates in the 2.4 to 2.45 GHz ISM band. The labels used with the TRANSIT system are all equipped with lithium battery's to power the internal logic. The labels do not contain a transmitter but are using the received power from the reader, after modification, for re-transmission to the reader. This principle is called modulated backscatter The labels are so called field modifying devices. The received RF power from the reader is modulated with the data from the chip containing the ID-number. To read a label there has to be a line of side to the label from the reader. Most synthetic materials are transparent for RF energy with little attenuation and are forming no obstruction. Snow and ice are no problem as long as it is in crystal form. Closed water films are a problem for the detection range. Heavy rain shall be no problem as long as there is no closed water film on the TRANSIT front cover or on the label. To reduce the influence of unwanted reflections circular polarization is used, this brings also rotation freedom for the label. Placing the labels on metal surface is not influencing the read range. One has to keep in mind that the misalignment is most of the time present in two planes. This makes simple evaluation of the coverage area difficult. A computer model has been developed in which most geometry's can be evaluated. Contact Nedap when in doubt.

The antenna diagram of the TRANSIT has a vertical beam width of 40° and a horizontal beam width of 80°. The labels are having a symmetrical diagram, 80° in the horizontal and vertical plane. The coverage area is based on the combination of the two diagrams. When defining the reading range between reader and label one should take in account the misalignment between reader and label. Good practice is to reduce the read range by a factor of two when the label is on the –3 dB points of the reader antenna and the normal on the label still parallel to the main axes of the reader.

One has to keep in mind that the misalignment is most of the time present in two planes. This makes simple evaluation of the coverage area difficult. A computer model has been developed in which most geometries can be evaluated. Contact Nedap when in doubt. In par. 4.5 the detection area for a number of practical situations is given.

4.3 Speed limitations.

The maximum speed a transponder can pass the reader antenna and the transponder can be read is depended on the following factors:

Item	Typical value
• **Length of the detection trajectory.**	6 meter
• **Distance between reader and tag.**	5 meter
• **Number of valid frames needed for valid read.**	3
• **Length of code.**	64 bits
• **Data rate**	1.875 KBPS
• **Frame time**	34 msec

In this situation a maximum speed of 200 km/hour can be allowed. For every other geometry one should carefully consider the above mentioned parameters before a specification on the maximum speed is defined.

This speed can ONLY be obtained with firmware in the 54 bit detection mode, see firmware user manuals.

4.4 Using more systems at the same location.

When two or more systems are within a range of 15 meters, these systems should have a frequency offset of at least 600 kHz with respect to each other. The frequency should be factory set. When in doubt or when two readers are 'looking' to each other, frequency offset is recommended. This frequency offset has to stay within the local radio regulations.

When two readers are heaving a frequency offset they can be mounted close together and they can read the same label at the same time.

4.5 Read range control TRANSIT-SUB. (Art. 7800150)

Until now to only possible way to reduce the reading distance of the TRANSIT in a controlled way was the use of so called reference transponders. A transponder without the correct customer code was placed in the reading area in such a way that only transponders which had a return signal stronger then this reference transponder could be recognized by the TRANSIT.

Due to the fact that it is not always possible to find a good position for a reference transponder or due to the fact that it is not possible to use a reference transponder from a cost or esthetical stand point the TRANSIT SUB (Squelch Upgrade Board) was developed.

TRANSIT SUB is a small PCB board which can be build into any TRANSIT.

TRANSIT SUB makes use of the already available AGC voltage (Automatic Gain Control Voltage) present in the Transceiver unit. This AGC- voltage represents the received signal strength of a transponder in front of the TRANSIT. When the orientation is fixed and no changes are present in the propagation path when the transponder is approaching the TRANSIT, this AGC voltage is a good measure for the distance between TRANSIT and transponder.

For the TRANSIT's equipped with the PS-270 Power-supply and the firmware P-61, Q-70 and P-70 there is the possibility to set the squelch reference level by means of commands via the serial data communication channel when the DC2/DC4 asynchronous protocol is selected.

4.5.1 Content TRANSIT retrofit kit.

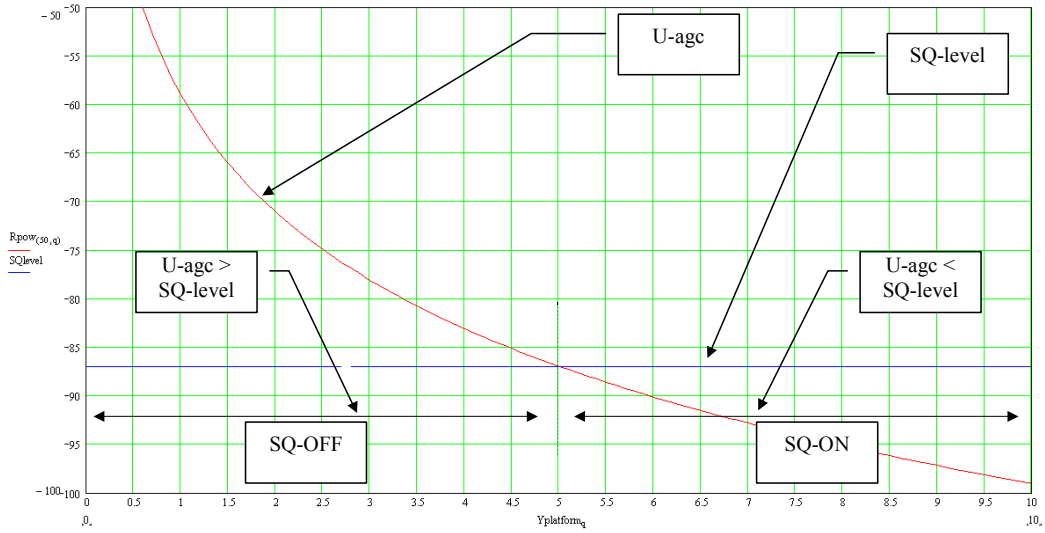
- 1x Printed circuit board TRANSIT SUB. (article 7800150)
- 3x Adhesive printed circuit board mounting supports.
- 1x 10 wire flat wire cable of approximately 100 mm.
- 1x 6 wire flat wire cable of approximately 100 mm.
- 3 colored wires for connecting the TRANSIT SUB to the PS-270 power supply unit.

WARNING:

When the TRANSIT SUB is placed and minimum squelch level is selected the maximum read range can be shorter then without the TRANSIT SUB.

4.5.2 Theory of operation.

When a transponder is moving towards the TRANSIT the received signal strength will change as function of distance. It should be clear that also tag orientation with respect to the TRANSIT reader determines the received signal strength. The AGC voltage (U-agc, agc = automatic gain control) is proportional to the received signal strength. TRANSIT SUB compares this voltage to an user settable reference voltage. This reference voltage is called the squelch level (SQ-level). When U-agc < SQ-level the squelch is active (SQ-ON) and the received transponder signals are suppressed. When Uagc > SQ-level the squelch is not active (SQ-OFF) and the received transponder signals are normally processed.



4.5.3 Squelch level setting.

The TRANSIT SUB has two ways of setting the squelch level (SQ-level); locally or remotely . Locally the squelch level can be set by means of potentiometer P-2 when the U-links K-7 and K-6 are set for position 2. Remotely the squelch level can be set by means of software commands, when the U-links K-7 and K-6 are set for position 1, which are controlling a so called DCP (digitally controlled potentiometer). The DCP has 100 positions and controls in this way a dynamic range of approximately 70 dB which means per step 0.7 dB in transponder return signal. Due to the fact that there is no linear relation between the transponder return signal and the distance the following relation between DCP step and distance is valid.

Transponder Distance meter	Change in distance for 1 step DCP in cm
2	10
4	15
8	25

The DCP rate of change when commanded up or down can be selected between fast and slow. Default is slow.
To step through the complete dynamic range (100 steps) between 100 and 50 seconds is needed in SLOW mode.
To step through the complete dynamic range (100 steps) between 20 and 17 seconds is needed in FAST mode.

For more detailed information refer to Manual TransIT-SUB

4.6 Typical situations.

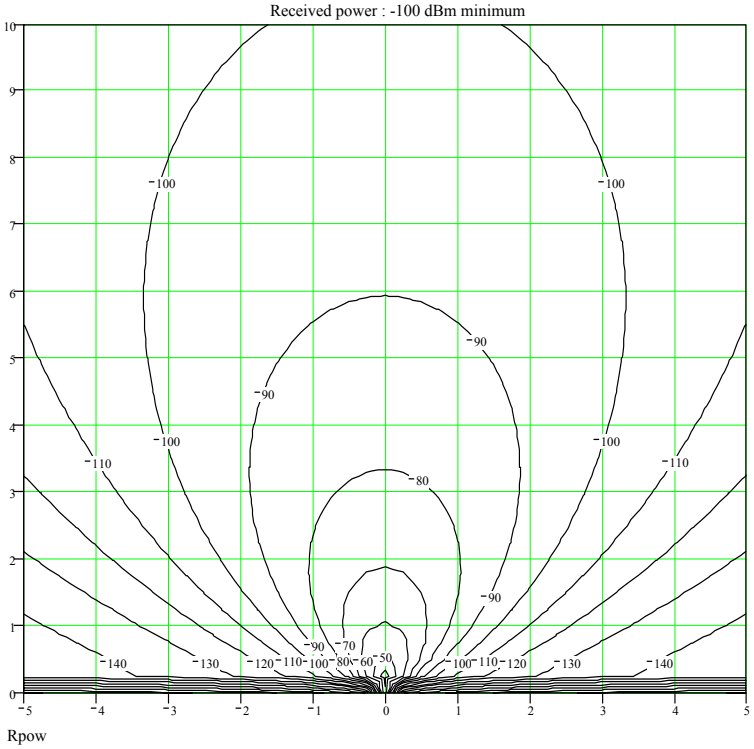
4.6.1 Introduction.

In the following diagrams a contour plot is shown of the received label signal. This contour plot gives always the top view of the situation. The position of the reader is always at 0,0. The label is positioned in a area of 10 by 10 meter. The scale of the plot is such that every square has a dimension of 1 by 1 meter. The minimum signal needed from the label is –100 dBm. This means that the area inside the –100 dBm contour represents the detection area.

The following parameters are used within the examples:

Parameter	Description.
R-height	Mounting height of the TRANSIT reader with respect of the ground.
D-angle	Angle over which the reader is rotated in the vertical plane. When D-angle is 0 degrees the reader 'looks' parallel to the ground. When D-angle is 90 degrees the reader is 'looking' straight down.
A-angle	Angle over which the reader is rotated in the horizontal plane.
L-height	Mounting height of the transponder with respect to the ground.
L-angle	Angle over which the label is rotated in the vertical plane. When L-angle is 90 degrees the label is 'looking' parallel to the ground. When L-angle is 0 degrees the label 'looks' straight up.

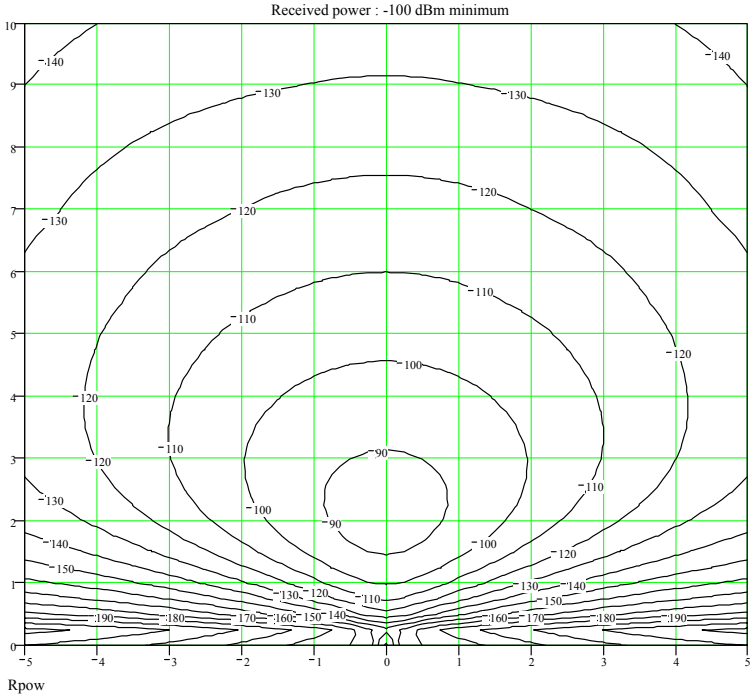
4.6.2 Example 1.



Parameter	Value
R-height	1
D-angle	0°
A-angle	0°
L-height	1
L-angle	90°

This example shows the ideal situation the reader is positioned at the same height as the label. This figure can be used for approaching labels as for labels passing at certain distance in front of the reader.

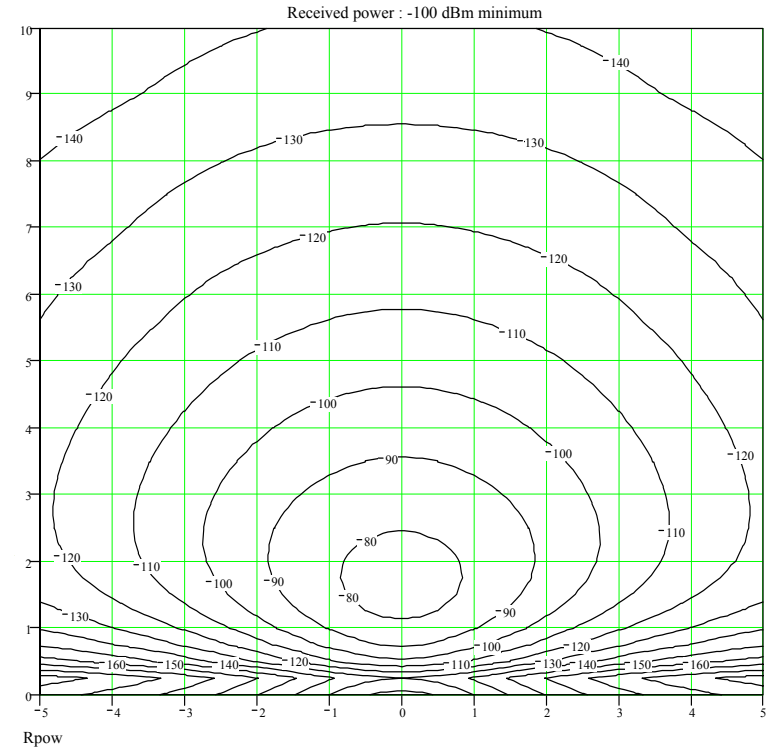
4.6.3 Example 2.



Parameter	Value
R-height	3
D-angle	45°
A-angle	0°
L-height	1
L-angle	90°

By placing the reader on a height of 3 meters and not adjusting the vertical angle of the label, we see a strong reduction in the detection area.

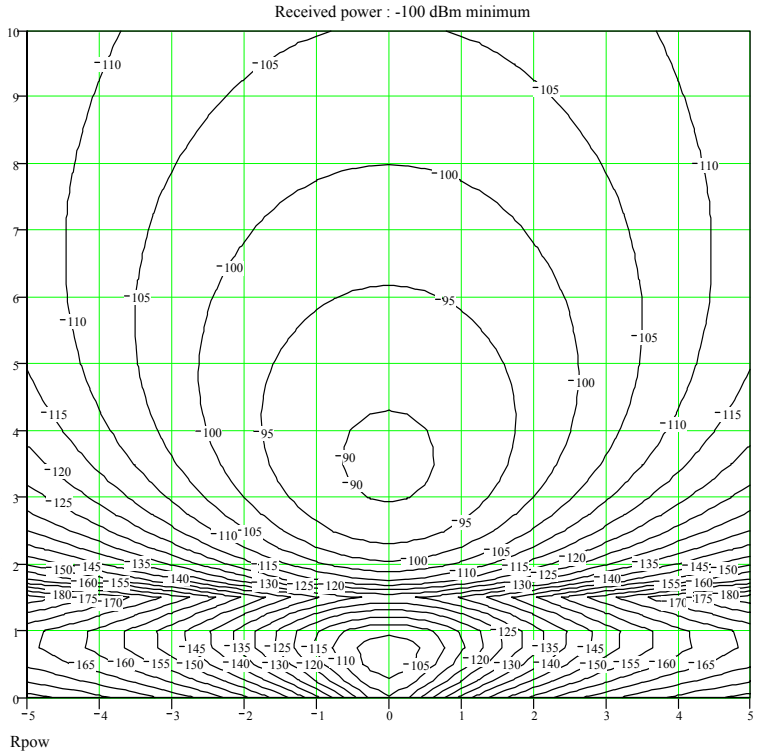
4.6.4 Example 3.



Parameter	Value
R-height	3
D-angle	45°
A-angle	0°
L-height	1
L-angle	45°

By letting the label look up 45° the detection area increases. Due to the reader D-angle of 45° at a height of 3 meters and a label height of 1 meter the maximum of energy is approximately 2 meters before the reader. This maximum could be placed much further out to improve the detection area.

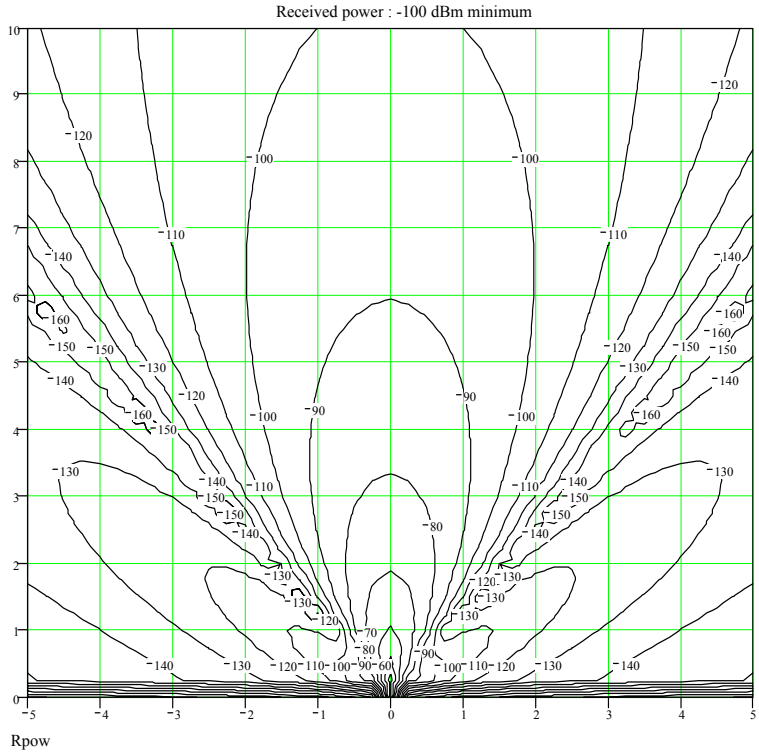
4.6.5 Example 4.



Parameter	Value
R-height	3
D-angle	15°
A-angle	0°
L-height	1
L-angle	45°

By reducing the reader down look angle (D-angle) to 15° the range is again improved.

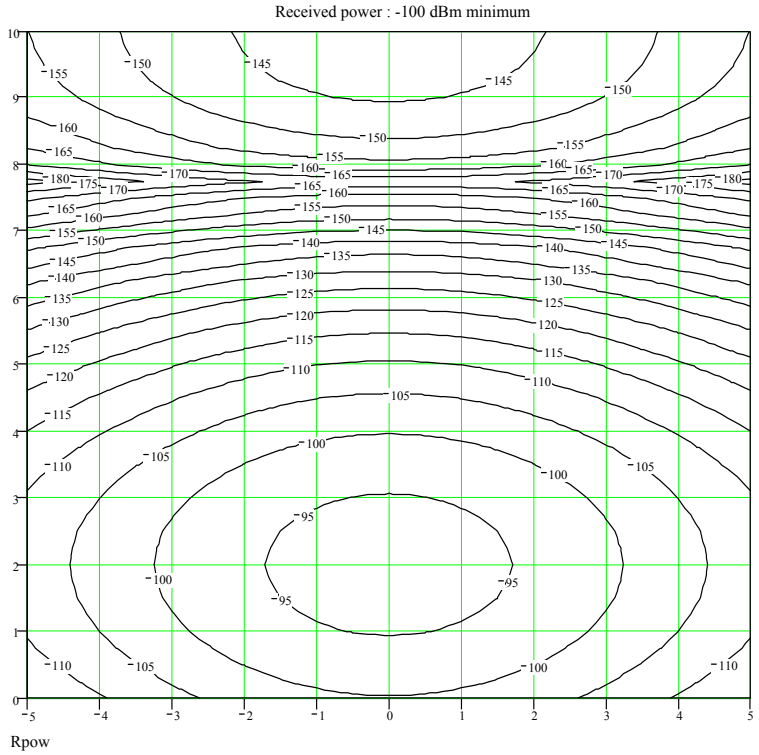
4.6.6 Example 5.0



Parameter	Value
R-height	1
D-angle	0°
A-angle	0°
L-height	1
L-angle	90°

This example shows the detection area when the TRANSIT reader is placed 90 degrees rotated. This means that the smaller beam width is in the horizontal plane. This results in a much narrower detection area which can be necessary in certain applications.

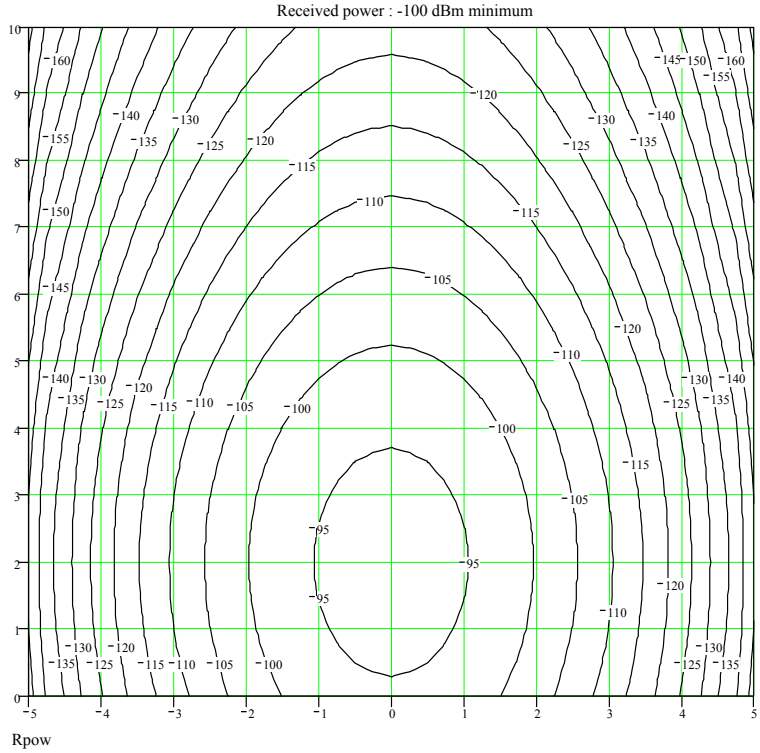
4.6.7 Example 6.



Parameter	Value
R-height	8
D-angle	90°
A-angle	0°
L-height	1
L-angle	0°

This is a situation were the reader sits on the ceiling 8 meters above a door. The reader position is 0, 2. The labels is at a height of 1 meter and is looking straight up.

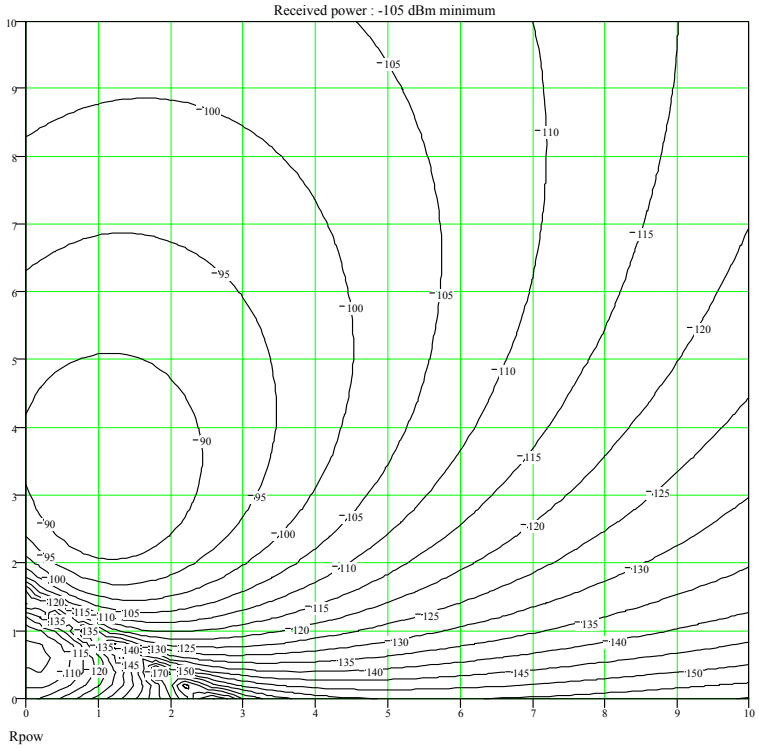
4.6.8 Example 7.



Parameter	Value
R-height	8
D-angle	90°
A-angle	0°
L-height	1
L-angle	0°

This is a situation were the reader sits on the ceiling 8 meters above a door. The reader position is 0, 2. The labels is at a height of 1 meter and is looking straight up. The difference with example 6 is that the reader is rotated 90 degrees to make use of the smaller beam width

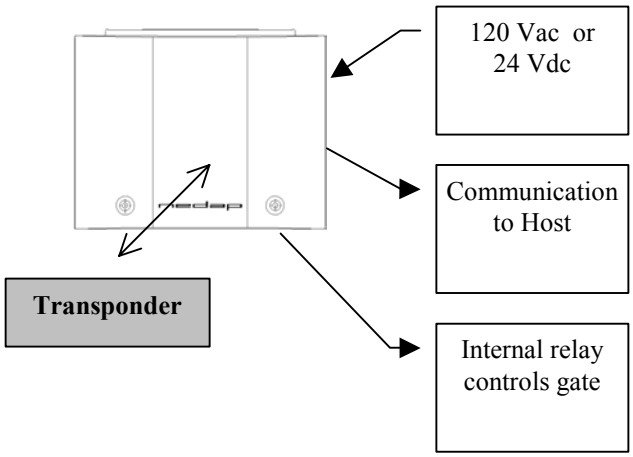
4.6.9 Example 8.



Parameter	Value
R-height	3
D-angle	15°
A-angle	30°
L-height	1.25
L-angle	60°

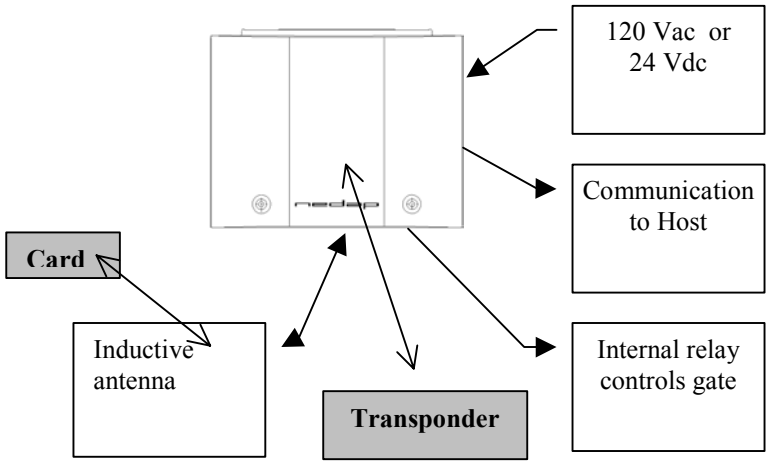
This example is typical for the situation where a label is behind the windshield of a car and the reader is placed along the road. The reader is rotated 30° towards the road in the horizontal plane.

4.7 Typical configurations.



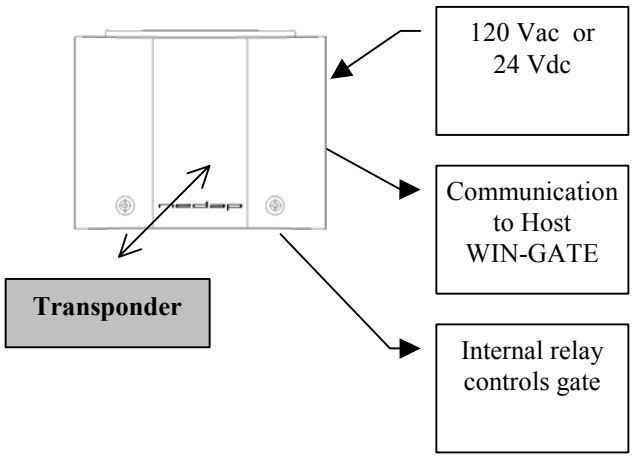
STAND ALONE

- Use of short authorization table possible.
- Profi-Bus or InterBus S network connection optional.



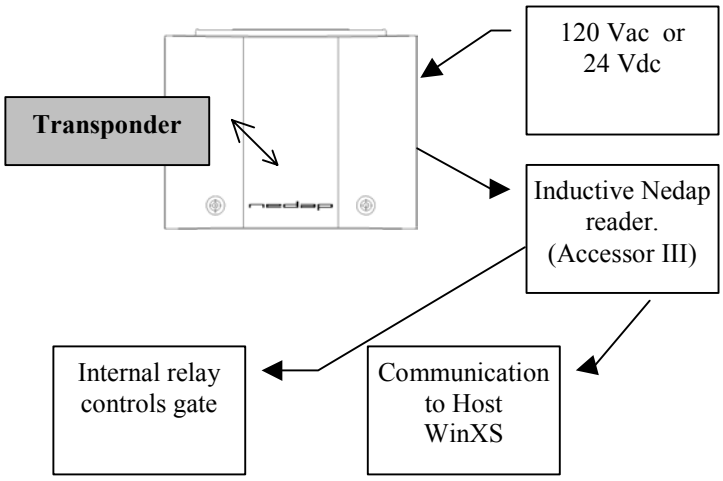
GATE MASTER

- Use of short authorization table possible.
- Reflex 130 as inductive antenna
- GATE MASTER firmware needed!



TRANSIT Extended

- Max. 1000 tag's in authorization table.
- Slave in multi drop loop. (32 slaves max)
- Loop control by means of WIN-GATE.



TRANSIT

- Max. 100.000 tag's in authorization table.
- TRANSIT connected to antenna input.
- Connection to any inductive reader possible.

Appendix A Technical specification

Item	Specification	Remarks
Housing	Stainless steel	
Dimensions	310 x 107 x 245	
Weight	< 5 kg	
Protection class	IP 65	
Temperature operational	-30°C .. +55°C	
Temperature storage	-40°C .. +85°C	
Relative humidity	10 .. 93% non-condensing.	
Identification range	Typical 10 meters	Tag in line of sight.
Object speed	200 km/h	Identification trajectory > 5 meter, 64 bit tag only.
Power supply	120 Vac +/- 10%, 200 mA, 50/60 Hz 24 Vdc +/- 10 %, 500 mA	DC supply shall be capable of delivering a 1 A inrush current.
Power consumption	30 VA (TRANSIT Extended) 18 VA (TRANSIT)	
Frequency range	2438.4 MHz .. 2457.0 MHz	Selected by DIP-switch, sealed in factory.
Number of channels	32	
Channel spacing	600 kHz	To be used when systems are close together.
Polarization	Circular (LHC)	
EIRP	Max 18.7 dBm linear	
Receiver sensitivity	-100 dBm	
Antenna gain	> 8 dBi	Valid for RX-array and TX-array
EMC	In accordance with the 89/336/EEC European directive EN 50081-1, EN 50082-1 EN 50082-2, ETS 0908	
Safety	EN 60950	
Complies to the following regulations	FCC Part 15.245 ETS 300 440	

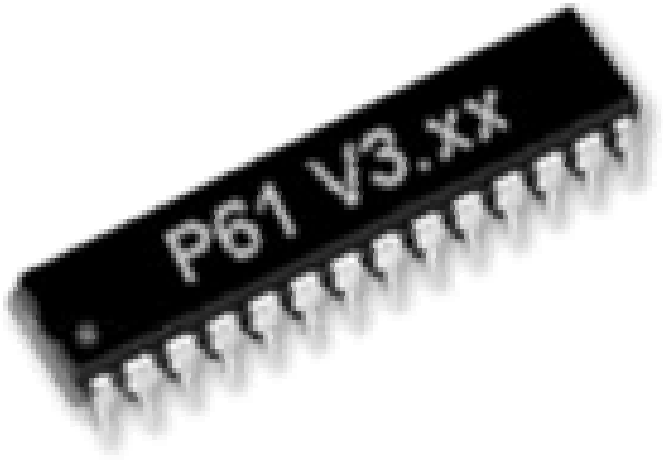
Appendix B Nedap part numbers.

ITEM	Part number	Description
• **TRANSIT**	9874801	Microwave identification system in stainless steel housing.
• **TRANSIT Extended**	9873694	Microwave identification system in stainless steel housing intended for access control.
• **Booster XS-card**	9848827	Tag which can be placed behind the windshield of a vehicle and in which a thick inductive card can be placed. Activation after pressing the card.
• **Booster ISO-card**	9848819	Tag which can be placed behind the windshield of a vehicle and in which a thin inductive card can be placed. Activation after pressing the card.
• **Window tag R/O.**	9862897	Tag which can be placed behind the windshield of a vehicle. This tag is always active. Number is factory programmed.
• **Window tag R/W.**	9866078	Tag which can be placed behind the windshield of a vehicle. This tag is always active. This tag can also be read and programmed inductively.
• **Switched Window tag R/O**	9866094	Tag which can be placed behind the windshield of a vehicle. This tag is only active for a short time after activation by the driver. Number is factory programmed.
• **Switched Window tag R/W**	9866086	Tag which can be placed behind the windshield of a vehicle. This tag is only active for a short time after activation by the driver. This tag can also be read and programmed inductively.
• **Heavy duty tag R/O**	9875689	This tag is a heavy-duty tag that can be mounted at the outside of many vehicles and is capable of exposure to harsh environmental conditions. This tag has an EX approval (Eex ia IIC T4) Number is factory programmed.
• **Heavy duty tag R/W 6**	9849289	Programmable with 6 decimal number by customer. 64 bit frame length including customer code.
• **Heavy duty tag R/W 80**	9875697	Programmable with 20 hexadecimal numbers by customer. 128-bit frame length **NO** customer code.
• **Combi Booster ISO**	9884025	This tag combines the functionality of a Window Tag and a Booster. Vehicle-ID is fixed programmed into the Combi-Booster. There are a number of operational modes. See Combi-Booster manual.
• **Combi Booster LCC**	9894017	As Combi Booster ISO but can hold the thicker XS-cards.
• **Pocket-tag R/O**	9882170	Credit Card sized microwave and inductive readable tag intended for identifying people. Uses simple multi tag protocol.
• **Pocket-tag R/W 6**	9881670	Credit Card sized microwave and inductive readable tag intended for identifying people. Uses simple multi tag protocol. Programmable with 6 decimal number by customer. 64 bit frame length including customer code.
• **RS 232 III**	7806434	Optional communication board.
• **CM422**	7811730	Optional communication board. (RS422)
• **Current loop II**	7803940	Optional communication board.
• **Profi-Bus DP**	7817134	Optional communication board for Profi-Bus networks.
• **InterBus**	7817169	Optional communication board for InterBus networks.

P61 firmware

for TRANS-IT (PS-270)

Installation Guide



28 June 2002 Part.no. 5268397

CONTENTS

1 INTRODUCTION 3
2 DIP SWITCH SETTINGS 4
3 LED INDICATORS 4
4 APPLICATION INFORMATION 5
4.1 DC2/DC4 PROTOCOL 5
4.1.1 EVENT MESSAGES 5
4.1.2 COMMAND MESSAGES 7
5 FIRMWARE UPGRADING 12
6 FIRMWARE REVISION HISTORY 12
A HARDWARE 13
B ASCII TABLE 14
C DC2/DC4 PROTOCOL 15
C.1 DATA FORMAT 15
C.2 PROTOCOL DESCRIPTION 15
C.3 SPECIAL CHARACTERS 15
C.4 DATA MESSAGE 16
C.5 CHECKSUM CALCULATION 16
C.6 FLOWCHART 17
D DECIMAL TO ASCII CONVERSION TABLE 18

1 INTRODUCTION

The P61 firmware is the standard TRANS-IT® (PS-270) firmware.
The TRANS-IT® is based on proven microwave technology in the 2.45 GHz ISM band and allows identification of tags at a distance up to 10 meters, even at high speeding passage. The P61 firmware combines microwave identification with inductive identification at 120 kHz.

The P61 firmware supports a wide range of transponders for various applications. The heavy duty tag is developed typical for vehicle applications. The window-tags can be mounted easily behind the windshield of a vehicle. The booster-unit is a special window tag, which is able to hold a NEDAP inductive identification card. This card is read by the booster. The combi-booster combines the features of the window-tag with a booster allowing to identify both vehicle and driver.

The P61 firmware supports the DC2/DC4 asynchronous communication protocol. This ASCII based communication protocol supports software handshaking and error checking. Identified transponders are automatically reported to any connected host computer in an event message, therefore no polling is required.

Below the main features of the P61 firmware are summarised:

- Supports DC2/DC4 communication protocol
- Identifies microwave 2.45GHz transponders and (if enabled) inductive 120kHz transponders.
- Decodes NEDAP PM-transponders, NEDAP Combi-Boosters and EM Marin 400x transponders.

2 DIP SWITCH SETTINGS

The TRANS-IT® (PS-270) has 8 DIP-switches, which are used by the P61 firmware as described in the table below. Refer to appendix A when locating the DIP-switches.

VALUE	8	7	6	5	4	3	2	1
Use default antenna	ON	x	x	x	x	x	x	x
Microwave and inductive antenna	OFF	x	x	x	x	x	x	x
Framelength 128 bit	x	ON	x	x	x	x	x	x
Framelength 64 bit	x	OFF	x	x	x	x	x	x
Manchester decoding disabled	x	x	ON	x	x	x	x	x
Manchester decoding enabled	x	x	OFF	x	x	x	x	x
Baudrate 9600	x	x	x	ON	ON	x	x	x
Baudrate 1200	x	x	x	ON	OFF	x	x	x
Baudrate 19200	x	x	x	OFF	ON	x	x	x
Baudrate 38400	x	x	x	OFF	OFF	x	x	x
Data format 7/even/1	x	x	x	x	x	ON	x	x
Data format 8/none/1	x	x	x	x	x	OFF	x	x

Table 1: DIP-switch settings

Note1: Set DIP-switch 8 only to OFF when using a TRANS-IT® reader with an inductive (120kHz) antenna connected. The P61 firmware then tries to identify transponders on both antennas (microwave and inductive). When on one antenna a valid transponder is identified it sticks to that antenna source and does not identify anymore on the other antenna. So, when a vehicle is identified with the microwave antenna and this vehicle stays in front of the TRANS-IT®, nobody is identified at the inductive antenna.

When identifying vehicles at high speed it is recommended to keep DIP-switch 8 in ON position.

Note2: Set DIP-switch 7 to OFF when no combi-booster or EF-coded transponders are to be identified. This increases the detection speed. DIP-switch 7 is only read during a startup.

Note3: Set DIP-switch 6 to OFF when manchester encoded transponders (e.g. EM Marin 400x) are to be identified.

3 LED INDICATORS

A number of LED's are used by the P61 firmware to indicate the current status. The table below describes the function of each LED. Refer to appendix A when locating the LED's.

LED	Description
STS	Status LED. Indicates that the power is on and the processor is running. The LED continuously blinks like the system's heartbeat.
ID	Identification LED. This green LED starts to blink fast when a valid transponder is identified. The LED stays off when no (valid) transponder is identified.
UL	Unlock LED. The unlock LED is normally off and goes on when a valid transponder is identified. The LED is turned off when no transponder is identified anymore and the relay-hold-time has elapsed. This LED can be connected to a Reflex or DC130 antenna. There is also a relay contact present which has the same function.
NA	Lock LED. Red LED indicating system standby. This LED is normally on and goes off when the unlock LED goes on. This LED can be connected to a Reflex of DC130 antenna.
INP / DOOR	Input status LED This red LED is on when the input contact is closed. The input is not used in the P61 firmware.

Table 2: LED indicators

4 APPLICATION INFORMATION

The main function of the reader is to detect NEDAP transponders and to transmit its identification number to a host computer. The id-number will be sent to the host in a so-called event message. A detailed description of each event message is given in chapter 4.1.1.
Command messages allow a host computer to change settings in the reader or to request information from the reader. The command messages are described in chapter 4.1.2.

4.1 DC2/DC4 PROTOCOL

DC2/DC4 protocol is the standard Nedap protocol which supports two-way communications, error checking and software handshaking.
This chapter describes the application layer of the DC2/DC4 protocol as it is implemented in the P61 firmware. Refer to appendix C for a description of the DC2/DC4 protocol details.

4.1.1 EVENT MESSAGES

Event messages are messages that report to the host computer that a specific event has occurred inside the reader. There are different types of event messages that may be send by the reader, like the detection event that is sent when a transponder is identified.

Event messages, when they occur, are stored locally in the reader in the event buffer. Once communication is idle the reader will try to transmit the event message. A maximum of 3 event messages can be stored. When the event buffer is full a new event will overwrite the oldest one. The event buffer is located in RAM memory and its contents will be lost when the power is off.

The reader may send the following event messages. Protocol dependant characters are not shown here. Spaces are added for clarity.

Spaces are only added for readability.

`O-event:` **Reader restarted**

Description:	The reader sends this event message as soon as the reader is powered-up to indicate that the system is active. Application settings stored in EEPROM were not lost.
Syntax:	`01 01 01 20 O [????????]`
Where:	`[????????]` Optional unused timestamp. Can be enabled with command message 0265.
Notes:	In case the P-event is sent the O-event is omitted.

`P-event:` **Reader reset**

Description:	The reader sends this event message as soon as the reader is powered-up to indicate that the system is active. Application settings stored in EEPROM were reset to their factory default. EEPROM settings are not lost when the reader is switched off. The EEPROM settings may be lost when the firmware is changed.
Syntax:	`01 01 01 20 P [????????]`
Where:	`[????????]` Optional unused timestamp. Can be enabled with command message 0265.
Notes:	In case the P-event is sent the O-event is omitted.

N-event: **Transponder identified (6-digit CF/DF/GF-code)**

Description: When a transponder is identified this event message reports its identification number. This event is only sent when a 6-digit transponder is identified. See also the timing diagram in Figure 1.

Syntax: `01 01 01 20 N [????????] nnnnnn`

Where: `[????????]` Optional unused timestamp. Can be enabled with command message 0265.

`nnnnnn` Identification number in range from 1 to 999999.

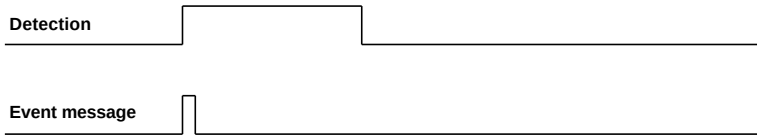


Figure 1: Timing diagram detection event

N-event: **End of detection (6-digit CF/DF/GF-code)**

Description: This event message is transmitted when a previously identified transponder is no longer present. The event is not send until the holdtime has expired.

Syntax: `01 01 01 20 N [????????] 000000`

Where: `[????????]` Optional unused timestamp. Can be enabled with command message 0265.

Notes: Not every detection event has to be followed by a end-of-detection event. See the timing diagram in Figure 2.

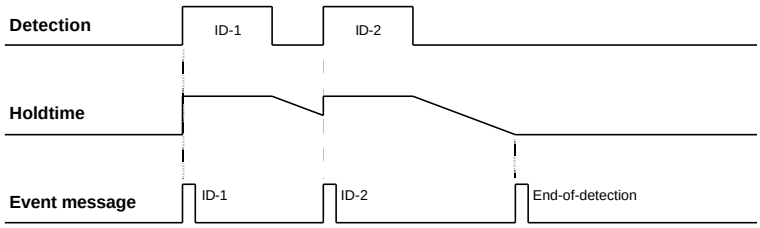


Figure 2: Timing diagram end-of-detection event

U-event: **Combi-booster identified**

Description: When a combi-booster is identified this event message reports both identification numbers. The first identification number is from the combi-booster, the second number is from the card which may be placed in the combi-booster.

Syntax: `01 01 01 20 U [????????] 0000aaaaaa bbbbbbbbbb`

Where: `[????????]` Optional unused timestamp. Can be enabled with command message 0265.

`aaaaaa` Combi-booster identification number in range from 1 to 999999.

`bbbbbbbbbb` Card identification number. Can be hexadecimal if a EM-Marin 400x transponder card is used.

Notes: When no card is placed in the combi-booster the second identification number is left blank (filled with zeros).

U-event: **Transponder identified (80-bit EF-code)**

Description: When a transponder is identified this event message reports its identification number. This event is only sent when an 80-bit transponder is identified.

Syntax: `01 01 01 20 U [????????] xxxxxxxxxxxxxxxxxxxx`

Where: `[????????]` Optional unused timestamp. Can be enabled with command message 0265.

`xxx...xxx` Identification number 80 bit hexadecimal.

`x` Hexadecimal character made out of 4 bits (nibble) added with the value of character '0'.

U-event: **EM-Marin 400x transponder identified**

Description: When a EM-Marin 400x transponder is identified this event message reports its identification number.
Syntax: `01 01 01 20 U [????????] 0000000000 xxxxxxxxxx`
Where: `[????????]` Optional unused timestamp. Can be enabled with command message 0265.
Notes: The EM-Marin 400x transponder may be identified by the inductive antenna (if enabled by DIP-switch 8) or by the microwave antenna when placed in a booster.

U-event: **End of detection**

Description: This event message is transmitted when a previously identified transponder is no longer present. The event is not send until the holdtime has expired.
Syntax: `01 01 01 20 U [????????] 00000000000000000000`
Where: `[????????]` Optional unused timestamp. Can be enabled with command message 0265.
Notes: Not every detection event has to be followed by a end-of-detection event. See the timing diagram in Figure 2.

4.1.2 COMMAND MESSAGES

The following command messages may be sent to the reader. Protocol dependent characters are not shown here.

`20` **Check communication**

Description: Command message can be used to check the communication with the TRANS-IT. The TRANS-IT will always respond with an ACK.
Syntax: `01010120`
Reply: `-`

`0243` **Request reader status**

Description: Request the current status of the reader. The reply message contains the transponder identification number.
Syntax: `0101010243`
Reply: `0101010243nnnnnn or 0101010243xxxxxxxxxxxxxxxxxxxx`
Where: `nnnnnn` Identification number 6-digit in range from 0 to 999999.
`xxx...xxx` Identification number 80 bit hexadecimal.
Example1: Window-tag number 12345
reply = `0101010243012345`
Example2: Combi-booster number 666666 with no inductive card
reply = `01010102430000666666000000000`
Example3: Combi-booster number 666666 with Em-Marin card 0100F246A8
reply = `0101010243000066666660100?246:8`
Example4: Booster with Em-Marin card 0100F246A8
reply = `0101010243000000000000100?246:8`

`0293` **Request firmware version**

Syntax: `0101010293`
Reply: `0101010293pppvvv`
Where: `ppp` Firmware name (P61).
`vvv` Firmware Version (100 = version 1.00).

0250 **Clear event buffer**

Description: Erase all events from the event buffer. Events are automatically erased from the event buffer when they are transmitted to the host computer. But it may be useful to clear the event buffer when the host computer has been offline for a while to remove 'old' events.
Syntax: 0101010250
Reply: -

0263 **Restart reader**

Description: Restart the reader. This is the same as turning the power-off and back on again, and will therefore be followed by an O-event (reader restart). All EEPROM settings are unaffected by this command.
Syntax: 01010163[W]
or: 0101010263[W]
Reply: -
Where: [W] Optional unused parameter to accept message compatible with other NEDAP readers.
Notes: See command message 02<>.

02<> **Reset reader**

Description: Restart the reader and reset all EEPROM settings to their factory defaults. The reader will generate a P-event (reader reset).
Syntax: 01010102<>[W]
Reply: -
Where: W Optional unused parameter to accept messages compatible with other NEDAP readers.
Notes: See command message 0263.

0255 Request timers

Description: Request timer values. Changed timer values are stored in EEPROM and are only lost when a 'reset reader' command is performed.
The relay hold time (also referred to as the unlock-time) is default 1 second. It causes the unlock relay to stay activated for the specified time after the transponder could not be identified anymore. See timing diagram in Figure 3. When during the relay hold time the same transponder is identified again the reader will not generate a new detection event.
The repeat time is default 0 seconds, which means that the detection event is only sent once. The repeat time causes the reader to transmit an detection event every 'repeat time' seconds for as long as the transponder is present. See timing diagram in Figure 4.

Syntax: `0101010255`

Reply: `0101010255AABBCCDD`

Where:

`AA`	Relay hold time in the range from 1 to 255 tenths of seconds. Use decimal to ASCII conversion table.
`BB`	Unused parameter (reserved for alarm time).
`CC`	Unused parameter (reserved for blocking time).
`DD`	Repeat time in the range from 0 to 255 tenths of seconds. Use decimal to ASCII conversion table.

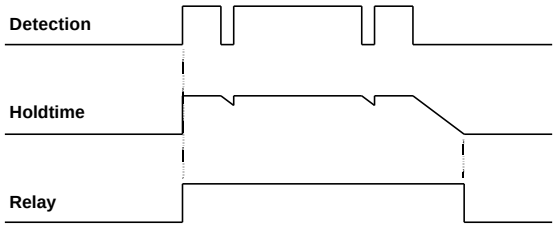


Figure 3: Timing diagram relay-hold-time

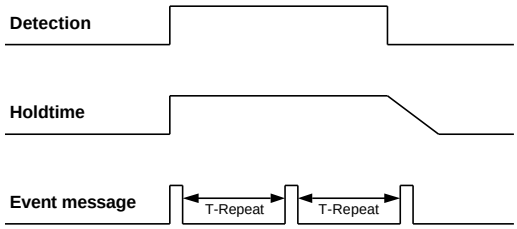


Figure 4: Timing diagram repeat time

0256 Set timers

Syntax: `0101010256TTT`

or: `0101010256AA[BB[CC[DD]]]`

Reply: `-`

Where:

`TTT`	Relay hold time in the range from 001 to 025 seconds.
`AA`	Relay hold time in the range from 1 to 255 tenths of seconds. Use decimal to ASCII conversion table.
`BB`	Unused parameter (reserved for alarm time).
`CC`	Unused parameter (reserved for blocking time).
`DD`	Repeat time in the range from 0 to 255 tenths of seconds. Use decimal to ASCII conversion table.

Notes: See command message 0255.
When only the relay hold time has to be changed, the other timer values do not have to be specified.

`0265` **Set 'time in event message' mode**

Description: Enables or disables the optional dummy timestamp characters in event messages. This setting is stored in EEPROM and is only lost when a 'reset reader' command is performed.
Syntax: `0101010265m`
Reply: `-`
Where: `m` 0 = disabled (default). Dummy timestamp characters in event messages will not be transmitted.
1 = enabled. Dummy timestamp characters in event messages are transmitted.

`0266` **Request 'time in event message' mode**

Syntax: `0101010266`
Reply: `0101010266m`
Where: `m` 0 = disabled (default).
1 = enabled.
Notes: See command message 0265.

`0267` **Set 'end-of-detection' mode**

Description: The end-of-detection event is a detection event with identification number 0. This event is only send when the relay-hold time has expired. See timing diagram in Figure 2. This setting is stored in EEPROM and is only lost when a 'reset reader' command is performed.
Syntax: `0101010267m`
Reply: `-`
Where: `m` 0 = end-of-detection event message disabled (default).
1 = end-of-detection event message enabled.
Notes: See command message 0255.

`0268` **Request 'end-of-detection' mode**

Syntax: `0101010268`
Reply: `0101010268m`
Where: `m` 0 = end-of-detection event message disabled (default).
1 = end-of-detection event message enabled.
Notes: See command message 0267.

0270 Set relay activation mode

Description: Set relay activation mode to manual or automatic. In manual mode the relay is only controlled by the command messages 0272, 0274 and 0276. In automatic mode the relay is also activated when a transponder is identified.
This setting is stored in EEPROM and is only lost when a 'reset reader' command is performed. Changing the relay activation mode updates the relay output status if necessary.

Syntax: `0101010270m`

Reply: `-`

Where: `m` 0 = automatic (default). Relay will be activated and de-activated when transponders are identified.
1 = manual. Relay is only activated and de-activated with command messages 0272, 0274 and 0276.

0271 Request relay activation mode

Syntax: `0101010271`

Reply: `0101010271m`

Where: `m` 0 = automatic (default). Relay will be activated and de-activated when transponders are identified.
1 = manual. Relay is only activated and de-activated with command messages 0272, 0274 and 0276.

Notes: See command message 0270.

0272 Activate relay

Description: Activate unlock relay.
The relay will not be de-activated until command message 0274 is received. When relay activation mode is automatic (default setting) the relay is activated when either this command is sent or a transponder is identified. When this command is sent the relay stays activated, also when there is no more detection. See also command 0270 to change the relay activation mode.

Syntax: `0101010272`

Reply: `-`

0274 Deactivate relay

Description: De-activate unlock relay.
When relay activation mode is automatic the relay may be activated if a transponder is identified. If this is the case, this command will not deactivate the relay until end of detection. See also command 0270 to change the relay activation mode.

Syntax: `0101010274`

Reply: `-`

0276 Activate relay single shot

Description: Activate the unlock relay for a period of relay hold time and automatically deactivate afterwards.

Syntax: `0101010274`

Reply: `-`

5 FIRMWARE UPGRADING

The Microchip PIC16F876 is a single chip flash based microcontroller, which allows to upgrade the firmware by the asynchronous serial interface. The upgrading is performed by a freeware application called "PIC downloader" which downloads the firmware file (*.hex) to the microcontroller. The upgrade procedure is described below. Note that the bootloader communicates always at 9600 baud, independent from the baudrate selected with the DIP-switches.

1. Select the firmware file (*.hex) by clicking the Browse … button.
2. Select the communications port to which the TRANS-IT® is connected.
3. Click the Download button to start downloading the firmware file.
4. The PIC downloader searches for the bootloader.
5. If the TRANS-IT® is properly connected and PIC downloader is setup correctly the firmware is downloaded. The window should look like shown in Figure 5.
6. Once the downloading has completed the PIC downloader displays the message 'Download successfully completed' and the TRANS-IT® starts the upgraded firmware.

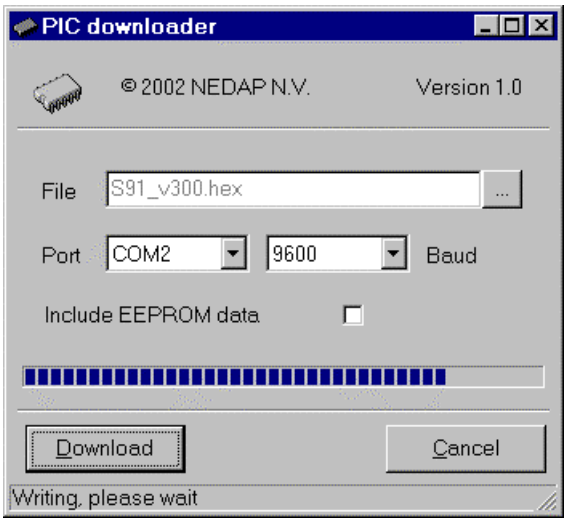


Figure 5: PIC downloader in progress

Note1: If the message 'Searching for bootloader' does not disappear check the cables and the com-port settings. Sometimes it may be required to reset the TRANS-IT® before the bootloader can be found.

Note2: Aborted downloads may cause the TRANS-IT® to stop functioning. In such cases repeat the upgrade procedure until it succeeds.

6 FIRMWARE REVISION HISTORY

Below the P61 firmware modifications are listed. For information on how to obtain the latest release of the P61 firmware contact Nedap.

Version	Date	Notes/Bugs fixed
v3.00		• First release

Table 3: Revision history

A HARDWARE

The P61 firmware is developed for the TRANS-IT® (PS-270) microwave reader. Below an overview of the hardware components is shown. For more details about the connections and electrical specifications refer to the TRANS-IT® (PS-270) installation guide.

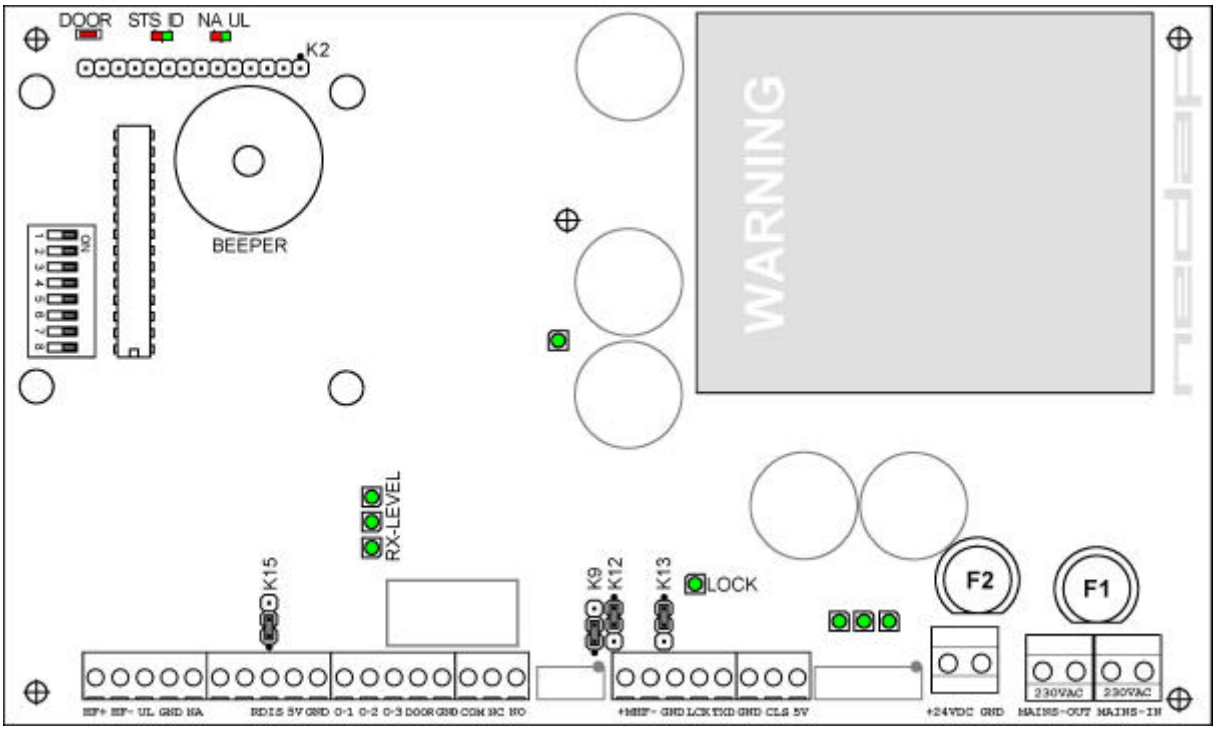


Figure 6: Overview PS-270 board

B ASCII TABLE

Dec	Hex	Char
0	0	NUL
1	1	SOH
2	2	STX
3	3	ETX
4	4	EOT
5	5	ENQ
6	6	ACK
7	7	BEL
8	8	BS
9	9	HT
10	A	LF
11	B	VT
12	C	FF
13	D	CR
14	E	SO
15	F	SI
16	10	DLE
17	11	DC1
18	12	DC2
19	13	DC3
20	14	DC4
21	15	NAK
22	16	SYN
23	17	ETB
24	18	CAN
25	19	EM
26	1A	SUB
27	1B	ESC
28	1C	FS
29	1D	GS
30	1E	RS
31	1F	US

Dec	Hex	Char
32	20	SP
33	21	!
34	22	"
35	23	#
36	24	$
37	25	%
38	26	&
39	27	'
40	28	(
41	29	)
42	2A	*
43	2B	+
44	2C	,
45	2D	-
46	2E	.
47	2F	/
48	30	0
49	31	1
50	32	2
51	33	3
52	34	4
53	35	5
54	36	6
55	37	7
56	38	8
57	39	9
58	3A	:
59	3B	;
60	3C	<
61	3D	=
62	3E	>
63	3F	?

Dec	Hex	Char
64	40	@
65	41	A
66	42	B
67	43	C
68	44	D
69	45	E
70	46	F
71	47	G
72	48	H
73	49	I
74	4A	J
75	4B	K
76	4C	L
77	4D	M
78	4E	N
79	4F	O
80	50	P
81	51	Q
82	52	R
83	53	S
84	54	T
85	55	U
86	56	V
87	57	W
88	58	X
89	59	Y
90	5A	Z
91	5B	[
92	5C	\
93	5D	]
94	5E	^
95	5F	_

Dec	Hex	Char
96	60	`
97	61	a
98	62	b
99	63	c
100	64	d
101	65	e
102	66	f
103	67	g
104	68	h
105	69	i
106	6A	j
107	6B	k
108	6C	l
109	6D	m
110	6E	n
111	6F	o
112	70	p
113	71	q
114	72	r
115	73	s
116	74	t
117	75	u
118	76	v
119	78	w
120	78	x
121	79	y
122	7A	z
123	7B	{
124	7C	|
125	7D	}
126	7E	~
127	7F	DEL

C DC2/DC4 PROTOCOL

DC2/DC4 protocol is the standard Nedap protocol which supports two-way communications, error checking and software handshaking.

C.1 DATA FORMAT

Baudrate: 9600(default), 1200, 19200 or 39400. Setup with DIP-switches (see chapter 2).
Databits: 7(default) or 8. Setup with DIP-switches (see chapter 2).
Parity: even(default) or none. Setup with DIP-switches (see chapter 2).
Stopbits: 1

C.2 PROTOCOL DESCRIPTION

The DC2/DC4 protocol is a serial, asynchronous protocol for ASCII communication.
The communications is started by sending a DC2 character and waiting for a DC4 character response. The DC4 character is the signal that the receiver is ready to accept a message. When there is no DC4 response within 2 seconds the communication is aborted. If the DC4 character is received the transmitter will send the data message and waits for an ACK or NAK character response. The ACK character is the confirmation that the message was correctly received. The NAK character is the signal that the receiver has detected an error in the data message. When there is no ACK response within 4 seconds the communication is aborted.
Both reader and host can startup the communication by sending a DC2. When the reader and the host startup the communication at the same time, the host will have the precedence to transmit it's message. The reader will (temporarily) withdraw. In other words the reader (and not the host) transmits a DC4 character.

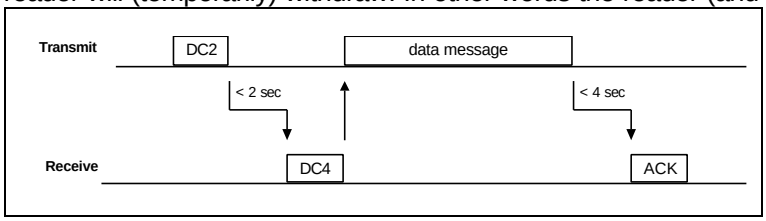


Figure 7: Timing diagram DC2/DC4 protocol

When an event message (initiated by Nedap) is not acknowledged the event is NOT be cleared from the event buffer. Nedap resends the event message later.
When a reply message is not acknowledged the reply is lost. The host has to resent the request in order to get the reply again.

C.3 SPECIAL CHARACTERS

The DC2/DC4 protocol supports 7 bit ASCII data communication. See also appendix B ASCII table.

The ASCII control characters are reserved for message handling. The remaining characters (in the range from 20 hex to 7F hex) are valid characters for the data.

The used special characters are:

DC2	12 hex	Are you ready to receive?
DC4	14 hex	I'm ready to receive!
STX	02 hex	Here comes the message.
ETX	03 hex	This was the message.
ACK	06 hex	I understood the message.
NAK	15 hex	I didn't understand the message.

C.4 DATA MESSAGE

The data message is built up as follows:

```
STX <ADDR> FF [ff] [data] <cc> ETX
```

Where:	STX	STX character.
	<ADDR>	Address. For P61 firmware always '010101'.
	FF	Two character command number. See chapter 4.1.2.
	[ff]	Optional two character sub command number. See chapter 4.1.2.
	[data]	Optional data.
	<cc>	Two bytes checksum.
	ETX	ETX character.

C.5 CHECKSUM CALCULATION

The checksum is calculated following the procedure below:

1. Sum all character values in the message. STX, ETX and the checksum itself not included.
2. This sum must be shortened into 1 byte.
3. Split this byte up into two bytes.
4. Finally add the value of character '0' to both bytes to make sure the checksum does not contain control characters.

Example:

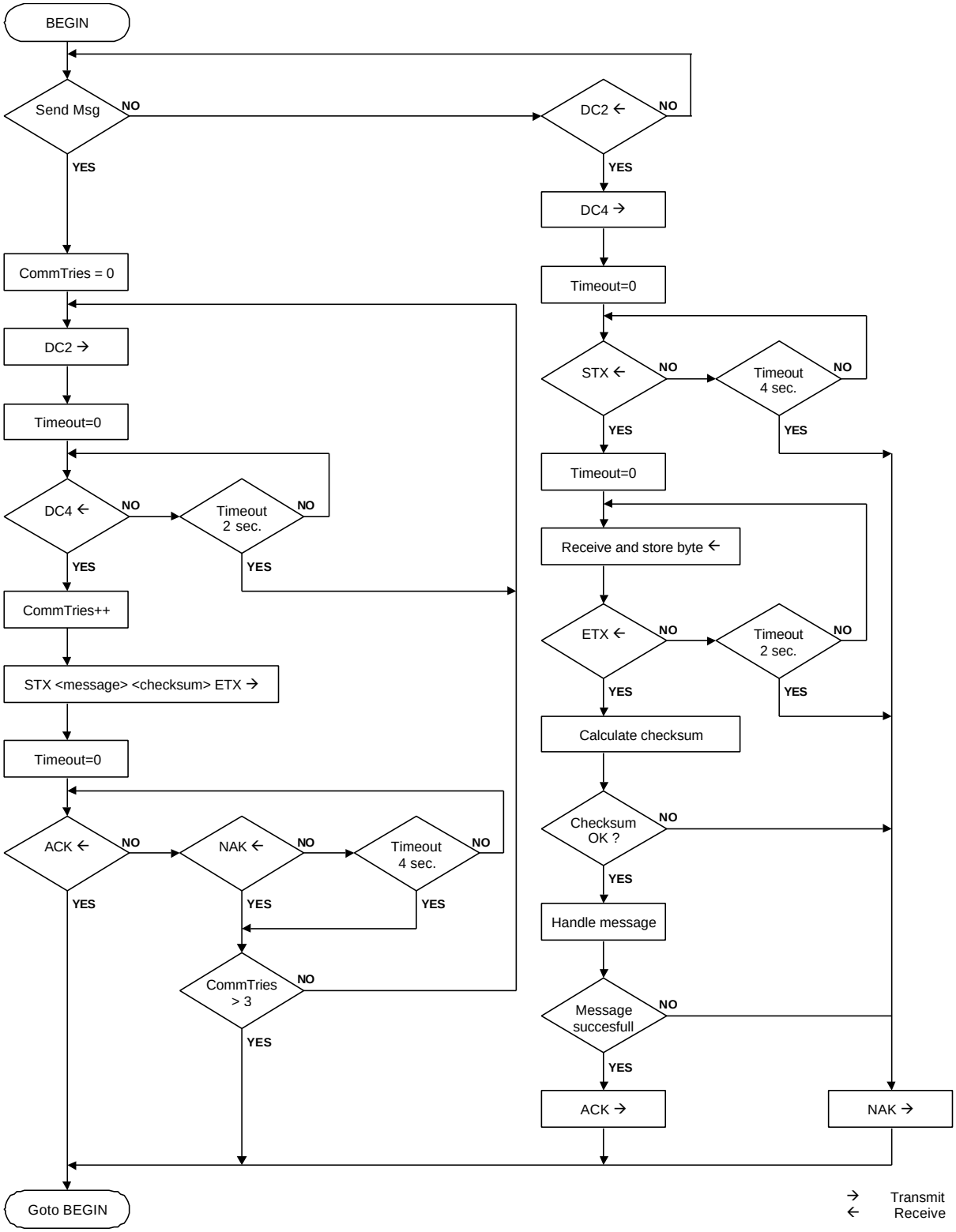
```
message = '0101010293'
```

ASCII characters are enclosed within quotes, all other values are in hexadecimal notation:

1. Sum all character values: 4 x '0' + 3 x '1' + '2' + '9' + '3' = 4 x 30 + 3 x 31 + 32 + 39 + 33 = 1F1.
2. Shorten sum into 1 byte: F1.
3. Split byte into 2 bytes: 0F and 01.
4. Add '0' to both bytes: 0F + '0' = 0F + 30 = 3F = '?' and 01 + '0' = 01 + 30 = 31 = '1'.

```
Complete message = STX'01010293?1'ETX
```

C.6 FLOWCHART



D DECIMAL TO ASCII CONVERSION TABLE

dec	ascii	dec	ascii	dec	ascii	dec	ascii	dec	ascii	dec	ascii	dec	ascii	dec	ascii
0	0 0	32	2 0	64	4 0	96	6 0	128	8 0	160	: 0	192	< 0	224	> 0
1	0 1	33	2 1	65	4 1	97	6 1	129	8 1	161	: 1	193	< 1	225	> 1
2	0 2	34	2 2	66	4 2	98	6 2	130	8 2	162	: 2	194	< 2	226	> 2
3	0 3	35	2 3	67	4 3	99	6 3	131	8 3	163	: 3	195	< 3	227	> 3
4	0 4	36	2 4	68	4 4	100	6 4	132	8 4	164	: 4	196	< 4	228	> 4
5	0 5	37	2 5	69	4 5	101	6 5	133	8 5	165	: 5	197	< 5	229	> 5
6	0 6	38	2 6	70	4 6	102	6 6	134	8 6	166	: 6	198	< 6	230	> 6
7	0 7	39	2 7	71	4 7	103	6 7	135	8 7	167	: 7	199	< 7	231	> 7
8	0 8	40	2 8	72	4 8	104	6 8	136	8 8	168	: 8	200	< 8	232	> 8
9	0 9	41	2 9	73	4 9	105	6 9	137	8 9	169	: 9	201	< 9	233	> 9
10	0 :	42	2 :	74	4 :	106	6 :	138	8 :	170	: :	202	< :	234	> :
11	0 ;	43	2 ;	75	4 ;	107	6 ;	139	8 ;	171	: ;	203	< ;	235	> ;
12	0 <	44	2 <	76	4 <	108	6 <	140	8 <	172	: <	204	< <	236	> <
13	0 =	45	2 =	77	4 =	109	6 =	141	8 =	173	: =	205	< =	237	> =
14	0 >	46	2 >	78	4 >	110	6 >	142	8 >	174	: >	206	< >	238	> >
15	0 ?	47	2 ?	79	4 ?	111	6 ?	143	8 ?	175	: ?	207	< ?	239	> ?
16	1 0	48	3 0	80	5 0	112	7 0	144	9 0	176	; 0	208	= 0	240	? 0
17	1 1	49	3 1	81	5 1	113	7 1	145	9 1	177	; 1	209	= 1	241	? 1
18	1 2	50	3 2	82	5 2	114	7 2	146	9 2	178	; 2	210	= 2	242	? 2
19	1 3	51	3 3	83	5 3	115	7 3	147	9 3	179	; 3	211	= 3	243	? 3
20	1 4	52	3 4	84	5 4	116	7 4	148	9 4	180	; 4	212	= 4	244	? 4
21	1 5	53	3 5	85	5 5	117	7 5	149	9 5	181	; 5	213	= 5	245	? 5
22	1 6	54	3 6	86	5 6	118	7 6	150	9 6	182	; 6	214	= 6	246	? 6
23	1 7	55	3 7	87	5 7	119	7 7	151	9 7	183	; 7	215	= 7	247	? 7
24	1 8	56	3 8	88	5 8	120	7 8	152	9 8	184	; 8	216	= 8	248	? 8
25	1 9	57	3 9	89	5 9	121	7 9	153	9 9	185	; 9	217	= 9	249	? 9
26	1 :	58	3 :	90	5 :	122	7 :	154	9 :	186	; :	218	= :	250	? :
27	1 ;	59	3 ;	91	5 ;	123	7 ;	155	9 ;	187	; ;	219	= ;	251	? ;
28	1 <	60	3 <	92	5 <	124	7 <	156	9 <	188	; <	220	= <	252	? <
29	1 =	61	3 =	93	5 =	125	7 =	157	9 =	189	; =	221	= =	253	? =
30	1 >	62	3 >	94	5 >	126	7 >	158	9 >	190	; >	222	= >	254	? >
31	1 ?	63	3 ?	95	5 ?	127	7 ?	159	9 ?	191	; ?	223	= ?	255	? ?