SY-780/A
Product Manual

Synel Industries Ltd.

Manual 4/9/03. Part no (SY-780-222-02) 650-135

This model is competible with PCB no. 770888-01-C

Terminology used in this manual

Warning

To warn readers about possible damage to equipment or data or about potential problems in the outcome of what they are doing.

Caution

To warn readers about the possibility of minor injury to themselves or others.

Note

To emphasize points or remind readers of something, or to indicate minor problems in the outcome of what they are doing.

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1. Introduction

The Synel SY-780/A Terminal is the latest addition to the ever-growing range of Time and Data Collection Systems developed and manufactured by Synel Industries Ltd. The newest member in the family of the 7xx series.

The newly developed SY-780/A is designed for effective time & attendance monitoring, production floor control, job costing, and access control applications. In addition, SY-780/A offers four mediums of access input: Fingerprint verification, magnetic card, bar code, and proximity readers.

The SY-780/A communicates in a **real time** interface with Ethernet/token ring databases, using TCP/IP or UDP protocols. Thus, the SY-780/A is a comprehensive interactive system. It provides online system management of employee reports as well as communication of current employees data.

Terminal communication programming employs Synel's state-of-the-art user-friendly interface provided by SYncomm or other advanced applications. This wide range of compatible communication applications supported by the SY-780/A terminal enables easily customizing the terminal to your unique requirements. Synel's SAL compiler enables flexible programming.

SY-780/A's mechanical design offers powerful yet easy programming while the back light and 32 character display allow quick and easy reading. The solid plastic casing and overall structure, make installation in an industrial environment simple and safe.

2. Technical Specifications

2.1 Technical and interface specifications

- 32 character LCD with back light display
- Eight programmable function keys
- Ten numeric keys
- Four special function keys: Escape, Return, dot and clear
- Two browsing keys
- Badge Reader [Magnetic, Bar code, or proximity depends on the terminal type]
- 512K of protected RAM
- Protected Real Time date/time clock
- Rechargeable backup battery (one month capacity) for the memory and Real Time clock
- Rechargeable backup battery for operation with auto shut-off for use during power outages
- RS-232 and RS-485 communication
- Two relays for bell, door, etc
- Two sensors (door monitoring)
- Variable baud rate - 1200 to 19200 bps

2.1.1 Options

- Fingerprint reader
  - Template size – 400 bytes
  - Response time – 3 seconds max
  - Security level – 5
  - Template storage - 4000
  - False accept/reject - 0.001
- Bar-code slot reader model (Code 128, code 2 of 5, Code 39, UPC-A)
- Magnetic (Track II, Track I)
- Proximity reader (125 KHz)
- Mifare reader (13.56 MHz)
- Wiegand 26bit, 37bit (Ver 5.01)
- Touch memory
- 2400/14400 bps internal modem
- Net connection (Ethernet & Token Ring)
  - Flexible, well- developed IP protocol stack
  - Ethernet (10BASE-T/100BASE-T or AUI) or Token Ring (STP/UTP)
  - Telnet and SNMP management

2.2 Physical characteristics

- Dimensions:
- Height - 17.0 cm
- Width - 25.0 cm.
- Depth – 9.5 cm.

2.3 Power Requirements

- Voltage: 115/230 VAC
- Back-up battery - rechargeable, included

2.4 Communication and configurations

2.4.1 Communication parameters

Communication between the host and terminals is performed under an asynchronous mode. The baud rate is programmable, enabling rates from 1200 to 19200 bps.

2.4.2 Multiple terminal configuration

RS-485 communication enables you to connect up to 32 terminals to a single COM port and/or to extend the cabling distance to up to 1,000 meters (3,280 feet) using 9600 baud via an RS-485 multi-drop line. RS-485 communication uses two wires as opposed to RS-422 communication, which uses four wires.

2.4.3 Port to port configuration

A single SY-780/A terminal, equipped with RS-232 communications, can be connected directly to an asynchronous RS-232 port. If RS-232 communication is used, only one terminal may be connected to each COM port and cabling distances should not exceed 50 meters (160ft).

2.4.4 Network connections

It can be connected to an Ethernet communications network or Token Ring. For this type of communication, an IP address is required for every SY-780/A terminal, making it possible to communicate with each terminal in TCP/IP protocol.

2.5 Selection of the data entry function

The SY-780/A terminal is ready for operation when a data entry function has been selected (after it was programmed). The prompt of the selected function will be displayed on the second line. To select a function, press the desired function key prior to entering the data.

2.6 Back panel for mounting

The SY-780/A has a removable square back panel with a hole in each end. This panel is used as a base for fastening the terminal to the wall.

2.7 Audible responses

When SY-780/A reads a fingerprint or a card, an audible response indicates that the action was confirmed/verified or rejected.

2.7.1 Approval tone

A long high pitched beep indicating the SY-780/A terminal accepts an employee clock-in.

2.7.2 Error tone

A series of short high pitched beeps indicating there is a problem with a clock-in attempt.

3. Physical Description

The SY-780/A terminal series is enclosed in a rugged plastic molded casing and is secured to the wall using four screws and a removable panel.

3.1 Front panel

1. A 32 character LCD with a back light display is located in the upper part of the front panel. Two arrow keys are located to the right of the display panel for line up and line down maneuvering.
2. Eight function keys are located on the left, below the display, and are marked as follows: *IN-* ,*OUT-* , F1, F2, F3, F4, F5, and F6.
3. A numerical keyboard of fourteen keys, including Return, Escape, and Clear are located in the lower center of the front panel.

4. The **Alarm** light is located to the left of the display. The alarm light is a LED that lights when at least half of the memory is used; it blinks when the memory is full or when the terminal has not been programmed.
5. The **ON** button enables a 15 seconds (modifiable using program) manual operation.
6. The fingerprint's drive ring on the right side of the SY-780/A. The internal badge reader/bar code/proximity is located below it.

3.2 Bottom connector panel

The connector panel is located at the lower part of the casing, withholding the socket openings for all external connections as follows:

1. Power supply
2. External secondary Reader
3. I^2C – I/O Extension (N/A)
4. Network
5. Connector cover
6. Serial I – Serial port connection for printer
7. Host – RS-232/RS-485

3.3 Internal components

3.3.1 Battery back-up modules

The SY-780/A has two back-up battery modules, one for the real time clock memory and the other for operation during a power failure.

The standard memory back-up module is a lithium battery, which will keep the internal clock running and the memory intact, for 30 days during a power failure.

The back-up battery provided (in addition to the standard memory back-up) is a self-recharging system which allows the terminal to be operated during a power failure. The battery provides power for one and a half net hours of use. A shut down timeout feature enables the terminal to operate for more

extended periods of time.

During a power failure, the user presses the battery key to activate the terminal. Data can then be entered and stored in the SY-780/A memory. The time-out will cause the terminal to shut down automatically after the last use of the terminal, until the battery key is pressed again.

3.3.2 Memory

As a standard feature, the SY-780/A Terminal contains a 512 Kbyte user memory, providing storage for data from more than 10,000 simple operations. This number depends on the length of the programming tables contained in the memory, and the complexity of the collected data.

3.3.3 RS-232/485 internal Card

This card provides an RS-232/485 serial interface.

4. Unpacking

Note: Do not throw away the box or packing materials.

Check the box and contents for signs of damage that may have occurred during shipment. After checking the box, carefully unpack and check for the following items:

4.1 Contents

The SY-780/A package contains:

- 1 SY-780/A terminal
- Mounting panel
- 1 control badge
- 1 connecting/splitter box (included only when TCP/IP is not available)
- Short RS-232/485 communication cable (included only when TCP/IP is not available)
- Short TCP/IP communication bridge cable (included only when TCP/IP is available)
- Four Phillips flat head 3.5x30mm and anchors, for terminal mounting purpose
- Mounting template
- Connector cover

5. Installation

5.1 Mounting the SY-780/A terminal on a wall

Make sure the unit is not plugged into a power source. If you have already connected your terminal to a PC, disconnect it. You can reconnect it after you have completed mounting the unit.

Caution: ***The terminal contains computer components. It should not be mounted where it will be exposed to extreme heat or cold, water, steam, violent vibrations, high electromagnetic radiation including high voltage power lines and electrical equipment.***

Step 1: Select an appropriate location for the SY-780/A terminal. It should be mounted at employee eye-height. The power plug serves for disconnecting the terminal from the power source. The terminal should therefore be placed near an easily accessible power outlet. Make sure that there is enough space enabling a safe communication cabling. Do not place the communication cable near a source of electromagnetic radiation or radio interference such as power lines, large machinery, etc. If the communication cable is to be wired through the wall, make sure that it is safe to drill a hole at the desired location. The recommended height is 140cm (4'7").

Step 2: Remove the back installation panel by sliding it to the side and pulling it out.

Warning: ***Live wires in the vicinity may contain 115V or 220V. Make sure not to drill into any live electric wires. Overlooking this warning may result in harmful contact with an electrical current.***

Step 3: Prepare the wall for mounting by placing the panel on the wall as a template and mark the place for drilling the holes.

Step 4: Drill holes using a 6 mm. (1/4") drill bit. If the communication cable is to be wired through the wall, wire one end of the cable into the wall.

Step 5: Screw the panel to the wall.

Step 6: Slide the SY-780/A terminal over the panel hinges.

Step 7: Connect the communication cable:
Plug one end of the communication cable into the communication socket of the SY-780/A terminal. If an internal modem has been added and the modem is used, plug the RJ-45 connector of a standard telephone cable into the telephone line. Do not use the SY-780/A communication cable.

Step 8: Plug the SY-780/A into the power socket.

Step 9: Re-place the connector cover at the bottom.

5.2 Communication connections

Step 1: Select a location for the connection box.
The box must be positioned where both the communication line and the terminal can be connected to it. The SY-780/A should be placed near the connection box, and must be within the reach of the short RJ45 cable.

Step 2: Plug the communication cable from the SY-780/A terminal into the connection box.

Step 3: Wire an additional connection for Ethernet and Token Ring connections.

6. Technician Mode (Setup)

Enter into Technician Mode by swiping an authorized badge or by clicking both the line up/down keys six times simultaneously (if the terminal is not programmed key-in 6 times 0). Use the **Enter** key to scroll between screens, and the line up/down keys for moving between options within the selected screen. To return to the previous screen use the C key. To exit technician mode double-click the **Enter** key. Technician mode enables setting up:

- Real Time Clock (RTC) Calibration
- Baud rate
- Fingerprint unit Baud rate
- Printer Baud rate
- Station ID settings
- Modem rings
- Network connection

Step 1: **Enter into Technician Mode:**
The display screen flashes for a five seconds interval and displays the version then flips to display the TECHNICIAN MODE and time and date alternately, (time&date are adjusted from the PC).

Step 2: **Adjust the RTC (N/Y)**:
This adjustment option is for internal clock calibration purposes.

Step 3: **Set date and time**:
The date is in DD.MM.YYYY format

Note: Setting date and time is enabled only when defining the system parameter in the SYNCOM software: ***Edit Program--> System--> Badge type choose S (System Administrator)****!*

Step 4: **Adjust host baud rate**:
Available baud rates: 1200, 2400, 4800, 9600 (default) and 19200.

Step 5: **Adjust fingerprint unit baud rate**:
Available baud rates: 57600 (default), 9600, 19200 and 38400.

Step 6: **Adjust printer baud rate**:
The available baud rates are: 9600 (default), 1200, 2400 and 4800.

Step 7: **Adjust station ID**:
The Station (terminal) ID is the SY-780/A's address on a communication line. It enables multi-terminal communication. Any number from 0 to 31 may be used as the terminal ID. Again, scroll to the required **Station ID** number.

Step 8: **Adjust the amount of modem rings**:
Choose either the number of rings or N for no rings.

Step 9: **Network connection**:
Programming the network connection requires addressing several sub-topics. The main screen enables three available modes: ***N*** for no connection, ***Y*** for answering when terminal has been addressed, and ***P*** for Polling, which means that a connection will be made whenever required.

Polling Sec

Determines the frequency of data transmission to the SY-Server software. If your terminals are not in online (query) mode, define the polling time as approximately 10-20 sec. Otherwise, raise polling time to avoid network collisions. Use the numeric keys to define your required polling time.

My IP Address

Press line up/down to view the TCP/IP address of the terminal. Use the numeric keys to enter the IP Address.

Gateway Address

Press line up/down and use the numeric keys to enter the required gateway address.

Remote Address

Press line up/down to view the TCP/IP address of the personal computer on which the SY-Server runs. Use the numeric keys.

Num Host Bits

Use the numeric keys to enter the required number of host bits (depending on your network mask).

My Port

TCP/IP enables connecting multiple applications via the same address. The port number selected here is the application identification number used by the computer when communicating with the terminal. Synel applications use the default port number = 5000. However, you may change this according to your specific needs. Use the numeric keys to change the port number.

Host Port

Synel applications use the default port number=5000. However, you may change this according to your specific needs. Use the numeric keys to change the port number.

Disconct Sec

Disconnect seconds defines the number of waiting seconds before reverting to offline mode. Click *03* to enable a fast disconnection.

Password

In order to avoid accessibility to the terminal IP address you can define a password. Requires installation of the “Password” software in your PC.

Send Ping

To verify that the connection to the host is valid, you can transmit a fixed message. The prompt displays the number of milliseconds between the time of transmission and time of receipt.

Ping Address

If you sent a ping (previous parameter), you must define the ping address. Access the Ping address, use the numeric keys to enter the address you want.

Send Dump

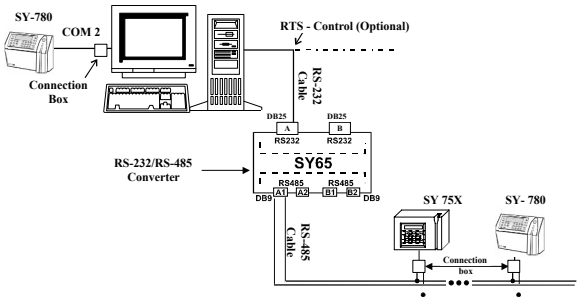
The terminal reformats the memory into accessible data blocks, and the data becomes available to the PC. This initiates transmission of all the data in the memory, therefore many insignificant blocks are received.

7. SY-780/A - Host Computer Interfacing

There are a number of different standard communication channels. The SY-780/A data collection terminal can be connected to the host computer using either an RS-232 or an RS-485 connection with an asynchronous serial port. RS-232 is used for a single device with a point to point connection, for distances up to 50 meters (160 ft). RS-232 is the communication standard used by nearly all PCs and modems. The cabling distance is limited to 50 meters (160 ft) and only one terminal may be connected to the same COM port. The RS-485 standard extends the potential cabling distance to 1,000 meters (3,280 feet). Using 9600 baud enables multi-COM port connections. It uses only two communication wires. The SY-65 communication adapter converts RS-232 to RS-485.

Note: Most computers use DTE type connectors on their RS-232 ports. The SY-780/A is equipped with an RJ45 (telephone jack) connector. Therefore, you will need a connection box intermediating the terminal and the host.

Figure 7.1: Direct (RS-232)/multi-drop (RS-485) connection



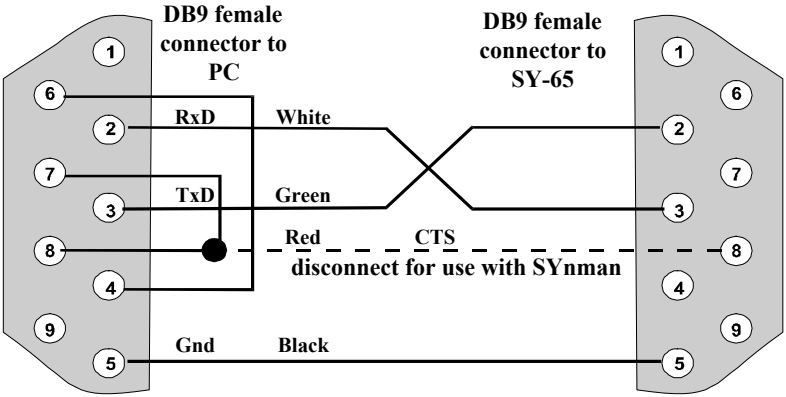
7.1 Installing communication cables

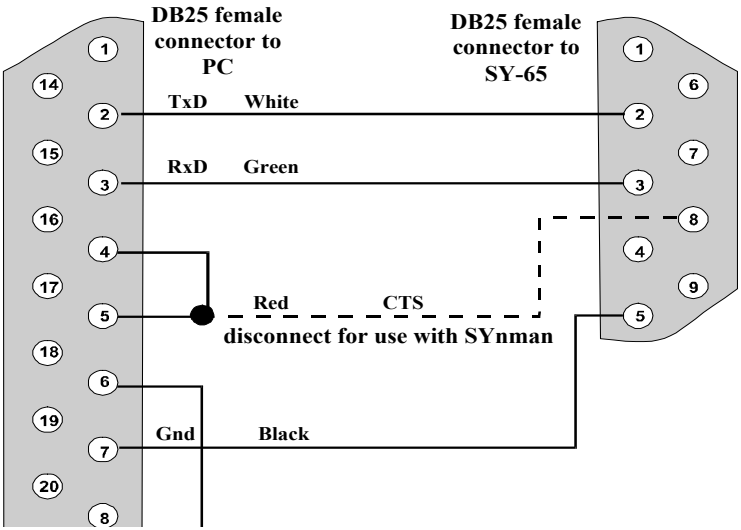
Follow these guidelines when installing the communications cables:

1. The cable should not be installed near an EMI sources, such as:
   - Motors, generators, alternators, and transformers
   - Air conditioners, elevators
   - Radio/television transmitters, signal generators and internal communication networks
2. Cables should not be within 30 cm. (1 foot) range from less than 5 KVA power lines.
3. Cables should not be within 60 cm. (2 feet) range from 5-10 KVA power lines.
4. Cables should not be within 1.5 meters (5 feet) range of power lines of exceeding 10 KVA.
5. Cables should not run parallel to power lines for more than 15 meters (49 feet).
6. It is best to use a single continuous cable for the communication line. If this is not possible, the cable should have only one connection, indoors, as follows:
   a. Using two connectors with appropriate shielding and cover.
   b. Using a connection box.
7. For aerial installation, use N.Y.Y shielded cables.

7.2 Connecting your PC to the SY-65

The SY-65 must be set to one of the RS-485 modes, i.e. 4,5,6 and 7. For more information, refer to the manual for the SY-65 communication adapter. The diagrams below describe the pin outs for the cable used to connect your PC to the SY-65 communication adapter. If your PC contains a 9-pin connector refer to the first diagram, if it contains a 25-pin connector, refer to the second diagram.



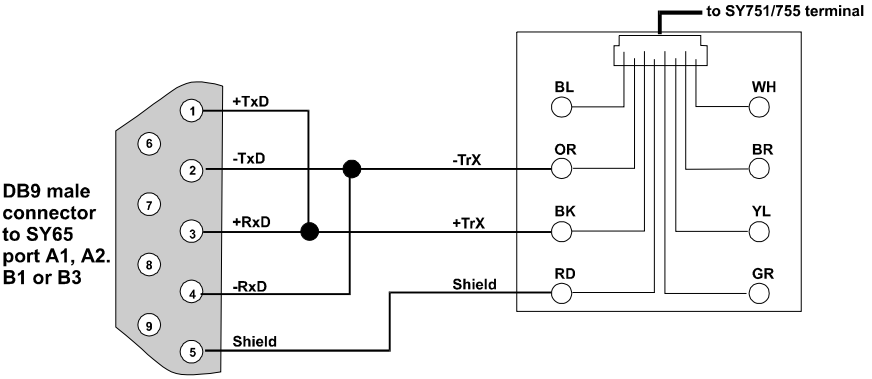


Note: RTS can not be used with SYNMAN communication software. The use of RTS is recommended with SCOMM communication software.

7.3 Connecting the SY-65 to a connection box

A 24 gauge, shielded two wire twisted pair cable should be used to connect the SY-65 to a connection box.

Step 1: Open the connection box.



Step 2: Connect the -TRX wire to the connection marked OR.

Step 3: Connect the +TRX wire to the connection marked BK.

Step 4: Connect the shield wire to the connection marked RD.

Step 5: Close the connection box.

7.3.1 If communication problems occur

1. Lower the baud rate.
2. Use cables with a heavier gauge conducting wire.
3. Connect 100 ohm resistors between the MRxD and PRxD, and also between MTxD and PTxD that are at the ends of the wire of the following two connectors:
   a. The connector on the computer.
   b. The connector on the last terminal of the multi-drop line.
4. EMI protection is integrated into the terminal, but it is best to use an external protector for lightning problems.

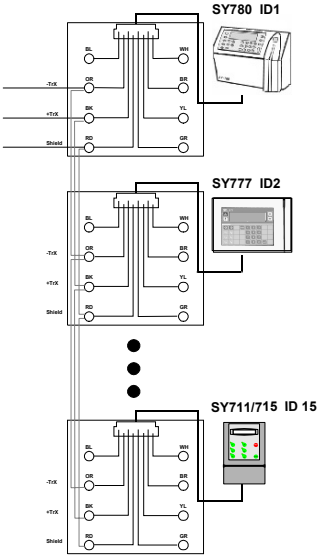
7.4 Making a multi-drop connection

Note: Terminal IDs are set at the terminal using the control badge. There is no procedure for hardwiring the terminal ID as in the SY-1XX and SY-4X terminals.

All terminals and their connection boxes are connected in exactly the same way, regardless of their terminal IDs. The multi-drop line may be created in one of two ways: creating a chain of connection boxes, using a junction box.

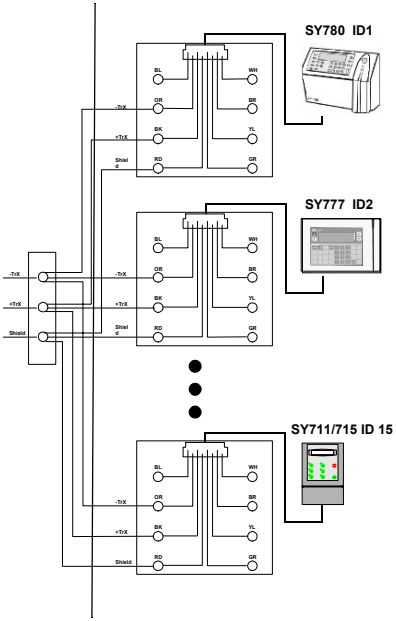
Method 1

The SY-65 is connected to a connection box which in turn connects to another connection box, thereby forming a chain as illustrated below.



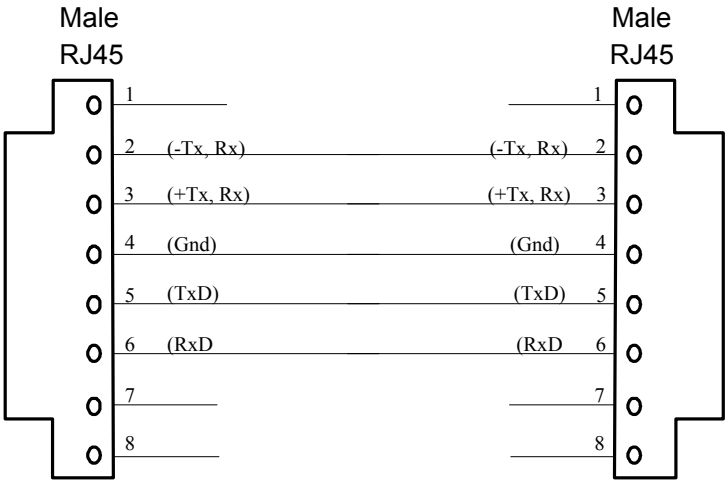
Method 2

The SY-65 is connected to a junction box. A separate cable is connected from each connection box to the junction box as illustrated below.



7.4.1 Cable from the SY-780/A to the connection box

This is a standard 6 wire telephone cable with an RJ45 connector cable which is supplied with the SY-780/A terminal. The pin locations are illustrated below to allow you to prepare such a cable. The length of the cable should not exceed 30 meters (98feet).



The RJ45 connector on the terminal's side must be a short (12.35mm) RJ45 connector to enable the SY-780/A connector case that hides the connectors to close.

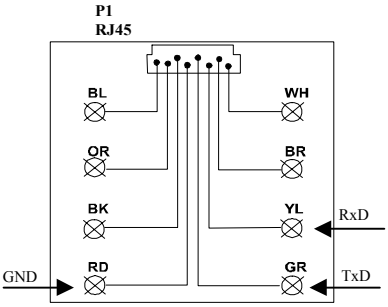
7.5 SY-780/A to the RS-232 PC port direct connection

Step 1: Open the connection box.

Step 2: Connect the TXD wire to the connection marked GR.

Step 3: Connect the RXD wire to the connection marked YL. Connect the ground wire to the connection marked RD.

Step 4: Close the connection box.



8. Maintenance

8.1 Terminal Maintenance

8.1.1 Once a month

Clean the badge reader:

1. For **magnetic** badge readers use a special cleaning badge made of plastic with a polishing paper (made of Al_2O_3, with a grain size of approximately 16 microns) attached to the part of the badge where it contacts the magnetic head. Swipe the badge once or twice. Excessive polishing will result in wearing out of the magnetic reader head.
2. For **barcode** badge readers use an air gun to remove dirt/dust/a special optical cleaner (e.i.: used for eye glasses to wipe dirt and dust off).

Caution: Alcohol based cleaning solutions must never be used to clean barcode readers.

8.1.2 Once every six months

1. Check the voltage of the UPS battery. If it is less than 7 volts, change them. Also make a visual check for leakage.
2. Clean all electrical contacts inside the terminal with a contact cleaner.
3. If a magnetic badge reader is used, clean it with a cleaning solution (such as pure alcohol).
4. Remove the JP7 jumper (**1**).
5. Check the voltage of the memory back-up battery and make sure that it is between 2.8V and 3.1V.
6. Replace the JP14 jumper (**1**).
7. Tighten the screws holding the power cable to the CPU card.
8. Verify that the components which have been assembled in the sockets are well adjusted.

8.2 Calibrating the Real Time Clock (RTC)

Warning: This operation must be performed by qualified and authorized personnel only! Work with an open unit. Make sure to unplug

the unit wherever the instructions call for it. Take extreme care during the stages where the terminal is plugged into a power source. Failure to heed this warning may result in harmful contact with electrical current.

If your terminal gains or loses time, you will need to calibrate it using a Time Counter unit, which has at least 5 places to the right of the decimal point (100,000ths of a millisecond), refer to Components side drawing.

1. Unplug the terminal and make sure that it is off. The backup battery automatically supplies power for approximately 15 seconds.
2. Unscrew and remove the front panel.
3. Remove the JP12 jumper. This disables the Watchdog utility.
4. Plug the terminal into a power source and enter the technician mode.
5. Make sure that the Time Counter is unplugged.
6. Connect the ground of the Time Counter unit to the ground pin at TP2 of the terminal's CPU board.
7. Reposition JP13 to 2-3 (calibration).
8. Connect the input of the Time Counter unit to the pin marked in JP13 jumper 2.
9. Plug the Time Counter unit a power source.
10. Set the Time Counter unit to test the period.
11. Press once on Enter; the message "Adjust RTC N/Y" appears.
12. Press once on Enter, for N (no). Use line up/down to scroll when selecting the Y (yes) option.
13. Calibrate the RTC of the terminal to 3.90625 milliseconds $\pm$ 0.00003 by turning the screw on the variable capacitor at C18.
14. Disconnect Jumper 2 pin at JP13.
15. Replace the JP13 jumper to 1-2 position.
16. Disconnect the connector from TP2 of the terminal's CPU board.
17. Return the JP12 jumper to re-enable the Watchdog utility.
18. Unplug the terminal.
19. Replace the front panel.
20. Unplug the Time Counter.

8.3 How to cause the memory to crash

Warning: ***Must be performed by qualified and authorized personnel only! It requires working with an open unit. Make sure to unplug the unit wherever the instructions call for it. Take extreme care during the stages where the terminal is plugged into a power source. Failure to heed this warning may result in harmful contact with electrical current.***

8.3.1 Location of jumpers

Step 1: Unplug the terminal and make sure that it is off.

The back-up battery automatically supplies power for approx. 15 seconds.

Step 2: Unscrew and remove the front panel.

Step 3: Remove the JP4 jumper from the 1-2 position to 2-3 position.

Step 4: Reposition JP4 to (1-2).

Step 5: Plug the terminal back into a power source and make sure that *MEM CRASH* reappears in the terminal display.

8.4 Formatting the memory if a crash occurs

If the memory crashes a *CRASH* message will appear. You will need to clear the terminal's memory and return the terminal to the *NO PROGRAMMING* state according to the procedure below.

Step 1: Press 6 times on the 0 key. An asterisk appears for each time that this key is pressed.

Step 2: Press on the Enter key once.

Step 3: Press 3 times on the line up key.

Step 4: Press twice on the line down key.

Step 5: Press 3 times on the line up key.

The message **CLEAR MEMORY?** will appear on the display.

Step 6: Press twice on the line down key.

Step 7: The message **MEMORY CLEARED** will appear on the display.

Step 8: You receive a **NO PROG** display.

The terminal then will be in the Technician mode. The message on the display will alternate between *TECHNICIAN MODE* and the date and time in the following format: DD/DW hh:mm:ss where DW represents the day of the week.

If you make an error during steps 3 through 6, the terminal will revert to the state just prior to step 3. If you are unable to complete this operation, exit the technician mode by pressing twice the **Enter** key. Then begin again.

8.5 Fingerprint sensor cleaning and care

A sensor is a rugged solid-state device designed to provide years of trouble-free service. Although maintenance and handling requirements are few in number, observance of a few basics maintenance steps will help to ensure a high level of performance over its life span.

8.5.1 Cleaning the Fingerprint Sensor

Oily deposits from your finger accumulate on the surface of the fingerprint sensor after repeated use. These can inhibit the functionality of the sensor.

Scheduled cleaning:

It is recommended to clean the sensor at least once a week, and also whenever an oily residue is visible on its surface.

Use Isopropyl alcohol (rubbing alcohol) and a clean cotton cloth or tissue paper to remove oily deposits.

Caution: Do not use a soiled cloth or tissue paper. A clean cotton cloth or tissue paper will absorb the deposits, but a soiled cloth will smear the deposits over the sensor's surface.

Alcohol is the preferred cleaning material because it dissolves oily residue and evaporates quickly.

The use of nylon brushes or scouring pads, abrasive cleaning fluids or powders, or steel wool is not recommended.

8.5.2 Caring for the Fingerprint Sensor

The sensor can be damaged by a discharge of static electricity from a human body. However, the fingerprint sensor is typically encircled by conductive plastic, which is connected, to a ground plane. You should always touch the conductive plastic before touching the sensor in order to safely discharge any static electricity that may be present on your skin or clothing.

Caution: ***Do not place the fingerprint sensor close to a heat source, such as a radiator or hot plate.***

Do not subject the fingerprint sensor to heavy shocks/vibrations.

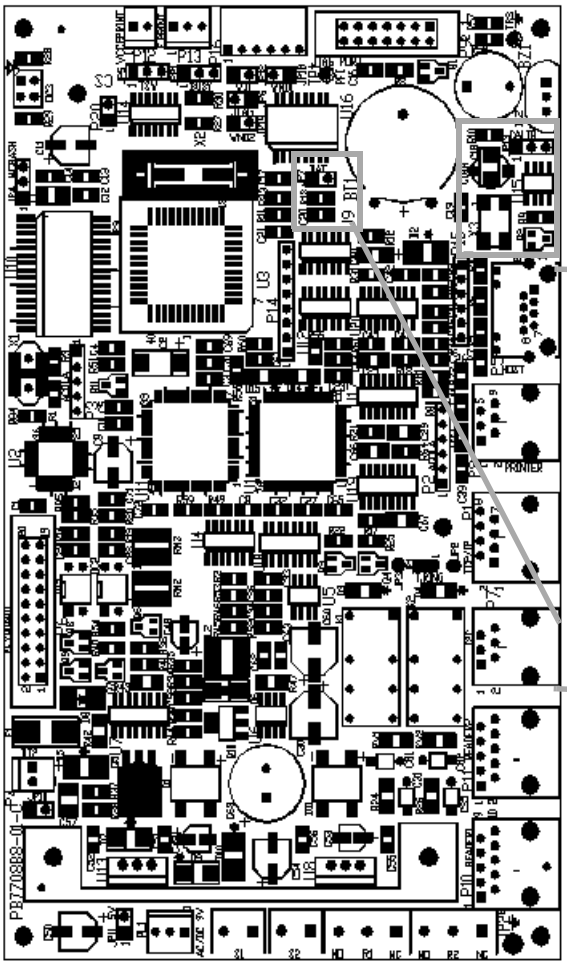
Do not allow the sensor to come in contact with metallic objects.

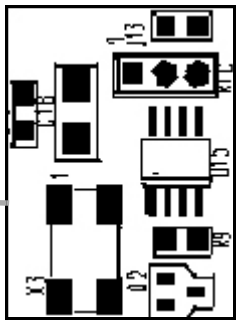
The sensor can be stored in temperatures ranging from -65^0C to $+150^0$C, and can operate in temperatures ranging from 0^0C to $+ 60^0$C.

In addition, the sensor should not be exposed to rain or excessive humidity. The sensor can operate within a range of 5% to 95% humidity (non-condensed).
With the exception of isopropyl alcohol, do not spill any liquids on the sensor.

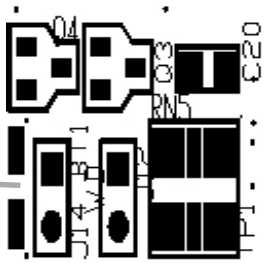
Connectors & Jumpers layout:

Components side (PCB no. 770888-01-C)



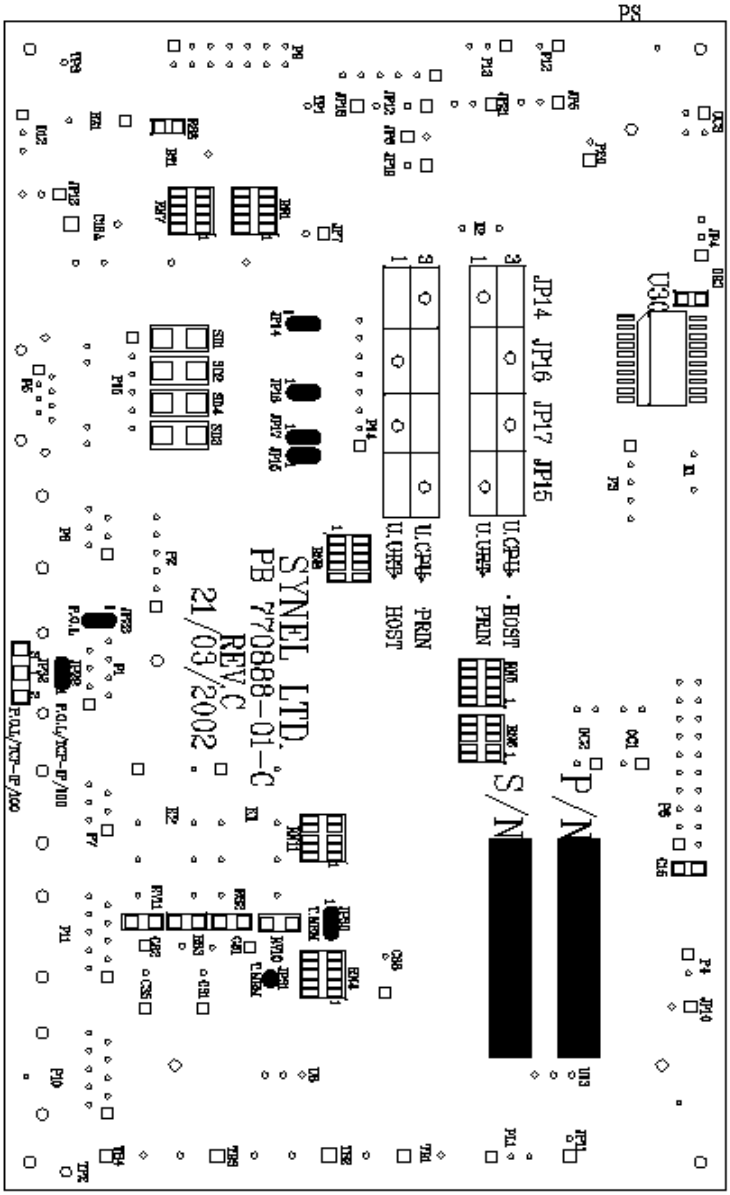


RTC

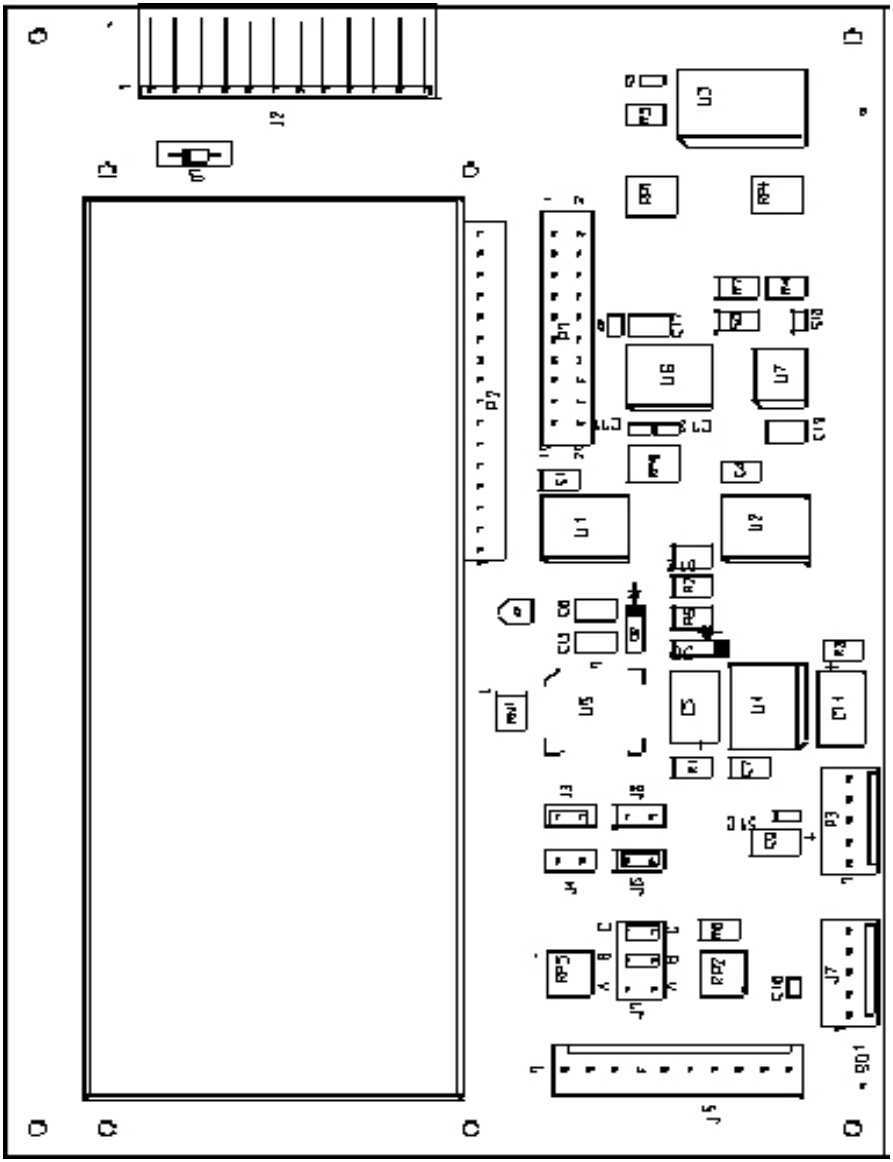


Battery

Printed side (PCB no. 770888-01-C)



Display card



Appendix - A

External Connectors

HOST RJ-45 (8 pin)
Communication with Host computer

Pin	Signal	Value	Remarks
1	NC		
2	RS-485 (-TRX)	0-5 Volt	
3	RS-485 (+TRX)	0-5 Volt	
4	GND		
5	RS – 232 (TXD)	-12:+12Vdc	
6	RS – 232 (RXD)	-12:+12Vdc	
7	NC		
8	NC		

Ser I - RJ- 11 (6 Pin)
Secondary serial channel for printer, scales or external PRintX

Pin	Signal	Value	Remarks
1	RS-232 TxD Transmit data	TX	Finger print
2	GND	0	
3	RS-232 RxDReceive data	RX	Finger print/Printer busy
4	RS - 232 TXD		Printer
5	RS – 232 RXD		Printer
6	VCC	5Volt	

Warning: When connecting an external PRintX there avoid connecting an internal PRintX!

NET RJ-45 (Ethernet/Token Ring/Modem)

Ethernet (Set JP1, JP2 and JP3 for Ethernet)

Pin	Signal	Value	Remarks
1	Transmit data	TX +	
2	Transmit data	TX-	
3	Receive data	RX +	
4	NC/Vin/Shield		10Base-T/Power over LAN/100Base-T
5	NC/Vin/Shield		
6	Receive data	RX -	
7	NC/GND/Shield		10Base-T/Power over LAN/100Base-T
8	NC/GND/Shield		10Base-T/Power over LAN/100Base-T

Token Ring (Set JP1, JP2 and JP3 for Token Ring)

Pin	Signal	Value	Remarks
1	NC		
2	NC		
3	Transmit data plus	TU +	
4	Receive data plus	RU +	
5	Receive data minus	RU -	
6	Transmit data minus	TU -	
7	NC		
8	NC		

Modem (Set JP2 and JP3 as Token Ring)

Pin	Signal	Value	Remarks
1	NC		
2	NC		
3	NC		
4	Ring	OP -	
5	TIP	OP +	
6	NC		
7	NC		
8	NC		

I^2C Bus – RJ 11 (6 Pin)

Pin	Signal	Value	Remarks
1	Serial Clock	SCL	
2	NC		
3	NC		
4	INT I2C		Interrupt input
5	GND		
6	Serial data	SDA	

P10 - External Reader 1(Magnetic /Bar code) RJ-45 (10 pin) (Optional)

P11 - External Reader 2(Magnetic /Bar code) RJ-45 (10 pin)

Magnetic reader

Pin	Signal	Value	Remarks
1	Data -		For RS-422 signal only
2	Led 1		
3	Led 2		
4	VCC		
5	GND		
6	Led 3		
7	Clock		Clock +, For RS-422
8	DATA		Data +, For RS-422
9	VS	9v	
10	Clock -		For RS-422 signal only

Bar code reader

Pin	Signal	Value	Remarks
1	Data(-)		For RS-422
2	Led 1		
3	Led 2		
4	VCC		
5	GND		
6	Led 3		
7			
8	DATA		Data +, For RS – 422
9	VS	9v	
10			

Wiegand

Pin	Signal	Value	Remarks
1	Data (6) -		For RS-422
2	Led 1		
3	Led 2		
4	VCC		
5	GND		
6	Led 3		
7	DATA1		Clock+, for RS-422
8	DATA0 +		DATA+, for RS-422
9	VS	9v	
10	Data (-)		Data (-) for RS-422

Note: Change JP18/19 accordingly.

Dallas (P10 - Reader 1 only)

Pin	Signal	Value	Remarks
1			
2	Led 1		
3	Led 2		
4	VCC		
5	GND		
6	Led 3		
7	CLOCK		Clock+, for RS-485
8			
9	VS	9v	
10			

Note: - Change jumpers 30, 31 accordingly.
- No additional readers can be connected.

Appendix - B

Internal connectors

Relays + sensors

PIN number	Signal	Description
TB1-1	Sensor 1	Input
TB1-2	GND	
TB2-1	Sensor 2	Input
TB2-2	GND	
TB3-1	Relay 1	Normally closed
TB3-2	Relay 1	Common
TB3-3	Relay 1	Normally open
TB4-1	Relay 2	Normally closed
TB4-2	Relay 2	Common
TB4-3	Relay 2	Normally open

Communication card sockets

Socket P14

PIN number	Signal	Description
P14-1	VCC	
P14-2	Busy	Printer busy RS-232
P14-3	Host-TX	TTL
P14-4	RX2	TTL
P14-5	DIR	COM' direction (TTL)
P14-6	RX1	TTL
P14-7	NC	
P14-8	GND	

Socket - P15

PIN number	Signal	Description
P15-1	NC	
P15-2	-TRX1	RS-485
P15-3	+TRX1	RS-485
P15-4	RXD1	RS-232
P15-5	TXD1	RS-232
P15-6	PR-Busy	TTL

Net Card Sockets

Socket P3

PIN number	Signal	Description
P3-1	VCC	
P3-2	GND	
P3-3	RX3	TTL
P3-4	Host-Tx	TTL
P3-5	Dir	Com. direction (TTL)

Socket P2

PIN number	Signal	Description
P2-1	TX+	
P2-2	TX-	
P2-3	TU+/RX+/OP-	
P2-4	RU+/RX-/OP+/Power over LAN/Shield	
P2-5	RU-/Power over LAN/Shield	
P2-6	TU-	

Fingerprint

Connector P12 (Power)

PIN number	Signal	Description
P12-1	VCC	
P12-2	GND	

Connector P13

PIN number	Signal	Description
P13-1	T1 Out	RS-232
P13-2	GND	
P13-3	R1 Input	RS-232

Connector P20

PIN number	Signal	Description
P20-1	ctsb	Clear To Send (TTL) for ISO-Modem
P20-2	NC	

Connector P4

PIN number	Signal	Description
P4-1	BAT+	Rechargeable BAT (+)
P4-2	BAT-	Rechargeable BAT (-)

Connector PL1

PIN number	Signal	Description
PL1-1	9v	Power supply
PL1-2	GND	

Connector P6 (LCD)

PIN number	Signal	Description
P6-1	VCC	
P6-2	GND	
P6-3: P6-10	KD0-KD7	Databus for LCD + keyboard matrix
P6-11	R/W	LCD read/write
P6-12	RSD	LCD register select
P6-13	E	Enable/Disable LCD
P6-14	leds	
P6-15	LIGHT	Back light enable
P6-16	#RES	RESET
P6-17/18	CL0/RD0	for reader (0)
P6-19	ON	ON-SWITCH
P6-20	Vs	9v

Connector P9 (PSD - JTAG PORT)

PIN number	Signal	Description
P9-1	JEN	
P9-2	TRST	
P9-3	GND	
P9-4	CNTL	
P9-5	TDI	
P9-6	TSTAT	
P9-7	VCC	
P9-8	RST	
P9-9	TMS	
P9-10	GND	
P9-11	TCK	
P9-12	GND	
P9-13	TDO	
P9-14	TERR	

Connector P16 (CPLD JTAG PORT)

PIN number	Signal	Description
P16-1	VCC	
P16-2	X-TDI	
P16-3	X-TMS	
P16-4	X-TDO	
P16-5	X-TCK	
P16-6	GND	

Appendix - C

Jumpers

Token Ring - Ethernet - Modem

No.	Jumper	Description	Value	Default/Note
1	JP1	TU - Token Ring	2-3 Ethernet 1-2 T.Ring/Modem	2-3 Ethernet
2	JP2	RU + Token Ring	Open Ethernet Close T. Ring/Modem	Open - Ethernet
3	JP3	RU - Token Ring	Open Ethernet Close T. Ring/Modem	Open - Ethernet
4	JP22/ 23/32	(1)NC/NC/NC--> modem/T.Ring/Ethernet 10Base-T		default (1) Modem & Ethernet connected via JP1/2/3
		(2)[(1-2),(2-3)]/[(1-2),(2-3)]/[(1-2)] Ethernet **10Base-T** with Power over LAN		
		(3)[(1-2),(2-3)]/[(1-2),(2-3)]/[(1-3)] Ethernet **100Base-T**		

PSD Programming

No.	Jumper	Description	Value	Default/Note
5	JP6	Jtag programming	Open - Normal work Closed - Programming	Open

Miscellaneous

No.	Jumper	Description	Value	Default/Note
6	JP12	Watch Dog in	Open WDI Disable Closed - Normal WORK	Closed
7	JP13	RTC	1-2 Normal work 2-3 Calibration	Normal work
8	JP7	Battery	Open Battery OFF Closed Battery ON	Closed
9	JP18	Reader 1 type	Wiegand - closed Other readers - Open	JP30 must be in (1-2) & JP31 must be closed
10	JP19	Reader 2 type	Wiegand - closed Other readers - Open	JP30 must be in (1-2) & JP31 must be closed
11	JP30/ JP31	Select DALLAS reader to channel (1)	JP30 [2-3] JP31 [OPEN]	Other readers can not be used!!
12	JP5	Tamper switch	[1-2] - Enabled [2-3] - Disabled	
13	JP21	Connect (R2 Input) to the printer busy or to the external FPU	[1-2] - External FPU [2-3] - Printer busy	
14	JP11	VCC	Closed - VCC ON Open - VCC OFF	
15	JP10	Testing current charging	Closed - Normal work Open - Test current	
16	JP14/ 15/16/ 17	VART selection	(1) (1-2)/(1-2)/(2-3)/(2-3) u.CPU--> Host u.URT --> Printer (2) (2-3)/(2-3)/(1-2)/(1-2) u.CPU--> Printer u.URT --> Host	Default = value 1

Appendix - D

Biometric concepts

Biometric Definitions

Enrollment is the operation of scanning a fingerprint, determining the quality of the fingerprint scan, and storing a good template with associated data within the memory of the MV1100/1200.

Scanning an Image

When the MV1100/1200 properly reads a fingerprint, it looks for image *quality* and fingerprint *conten*t. When a raw image is collected from the sensor during enrollment, verification or identification, the MV1100/1200 searches for the fingerprint core.

Content scores are based upon the amount of non- ambiguous data in the region of the core. The higher the content, the greater the degree of useful information.

See Using Content and Quality for Enrollments for a thorough discussion of content

Quality scores are based on how well the ridge pattern is defined within the image. For best image *quality*, be sure that the sensor window is clean, residue, or other material that can block the MV1100/1200's view of the FP.

Once the image is scanned, the MV1100/1200 then creates and stores the resulting fingerprint template.

Verification is the operation of entering a PIN #, requesting the user to place their finger on the MV1100/1200, scanning the finger, comparing the current scan against stored fingerprint templates for that user, and then notification of a successful validation or a failure.

Identification is the operation of requesting the user to place their finger on the MV1100/1200, scanning the finger, comparing the current scan against all stored fingerprint templates (regardless of user). If the user is in the database, identifying the user. Identification is only available on a searching MV1100/1200's.

Fingerprint Template is the data stored on the MV1100/1200 that mathematically represents the pattern of an enrolled fingerprint. This data is not the raw image of the fingerprint, but the result of processing a raw image through our unique algorithmic process, preparing the data for later comparisons, and compressing the data for maximum storage. An image of the uncompressed template data does resemble the raw image, but whereas a raw image is 90K bytes, the compressed template is only 348 bytes.

Fingerprint Core is the term used to describe distinguishing print characteristics usually found in the area of the print where the topography shows the tightest curvature. Although the entire fingerprint has significant data, the "core" is the most data- intensive area and therefore very important.

Proper Finger Placement

The basics for successful operation of the MV1100/1200 are important.

System performance improves dramatically with ***consistent finger placement.*** It is important to make sure that the position of the finger allows the MV1100/1200 to record the unique features of the print. Here are the steps to follow for trouble-free fingerprint recognition.

- BIO ID has designed the Ridge- Lock and the Finger Guide to create "simple user instruction" and "consistent" finger position. With the fingertip raised, position the finger so that the Ridge- Lock rests comfortably within the first indentation of the finger. Next, lower the finger onto the sensor and apply moderate pressure. This figure illustrates proper finger placement and the resulting image of the scanned fingerprint.

Sampling Do's and Don'ts:

- Place your finger within the sensor's groove (Do not use your thumb to enrol).
- Touch sensor's plastic casing (black) in order to discharge static electricity.
- Lean your finger against the ridge lock, and gently lower it onto the sensor panel so that most of the core is within the drive ring area. Touch the metal plate that surrounds the silicon. Avoid excessive pressure as it will blur the fingerprint (if insufficient pressure is applied, it will result in a partial scan).
- If your finger is extremely dry, touch your forehead or the side of your nose before sampling.
- Do not move your finger while scanning!
- Manual workers should avoid using their right hand to enrol, as their right-hand fingers could be callous or damaged.
- Dry-up a wet or moist finger before scanning!

Note: - Do not use your thumb for enrolment.
- After swiping your card, when entering, always place the already enrolled finger for verification!

Common mistakes

Correct finger placement is a significant component for reliable fingerprint imaging. The following figures illustrate some common mistakes to avoid.

- Sliding the fingertip into place instead of lowering it onto the sensor will cause distortion of the fingerprint and will degrade image quality. Keep the fingertip raised while locating the Ridge- Lock, then lower the fingertip.
- Rotating the finger into position will also cause distortion of the fingerprint, subsequently making verification less reliable.

- Placing your finger as if punching a button will not provide adequate information and will degrade system performance. Proper sensor height and angle along with consistent use of the Ridge- Lock deters this behaviour.
- Positioning the finger to one side and leaving a portion of the sensor exposed will degrade image quality. This figure demonstrates how poor finger placement degrades the image of the fingerprint. Notice how the core is well off- centre and the sensor is not fully covered.

- Placing the finger at an angle to the finger guide, as shown below, is another common mistake. Rotation of the fingertip will not provide a reliable image of the fingerprint.

- Not using the Ridge- Lock will prevent the MV1100/ 1200 from imaging the main features of interest. This figure illustrates the user neglecting the Ridge- Lock and resulting fingerprint image. Notice how the core is well below centre and the sensor is not fully covered.

Reasons for Low Scores

Some reasons for poor sampling results are listed below:

Possible Reason	Correction
Finger movement while sampling	Instruct the user to remain still while Veriprint is sampling.
Finger not positioned properly	With the fingertip raised, position the finger so that the Ridge- Lock rests comfortably within the first indentation of the finger. Next, lower the finger onto the sensor and apply very moderate pressure.
User might be pressing too hard	Too much pressure on the sensor will blur the fingerprint ridges. Allow the user to apply gentle pressure while sampling.
User might not be pressing hard enough	You must apply gentle pressure when enrolling. The fingerprint should lay flat upon the sensor surface.
Finger too moist or wet	If the user washed their hands, but failed to completely dry the finger that is sampled, excessive moisture may cause the sample to be more difficult to obtain. Dry wet or moist fingers before sampling.
Finger too dry	Depending upon the geographical area, the season, and the skin type of the user, their fingerprint might be excessively rough or dry. Excessively dry skin may affect the sample quality. Try applying skin moisturizer a few minutes before enrolling to improve image quality.

Appendix E - Programming via SYncomm

1. Introduction

The SY-780A can be programmed by a SAL program to meet any requirements in the field of access control. However programming via Syncomm is much easier, but has some limitations. The SYComm program is written to accept parameters that are grouped into designated tables.

SAL programming provides high flexibility: the terminal database structure can be modified and programming is performed according to tailor-made specifications. This elite assembler program know-how requires invested training hours as it is an intricate program to master. This document will not specify SAL programming method for detailed information, refer to SAL programming user manual.

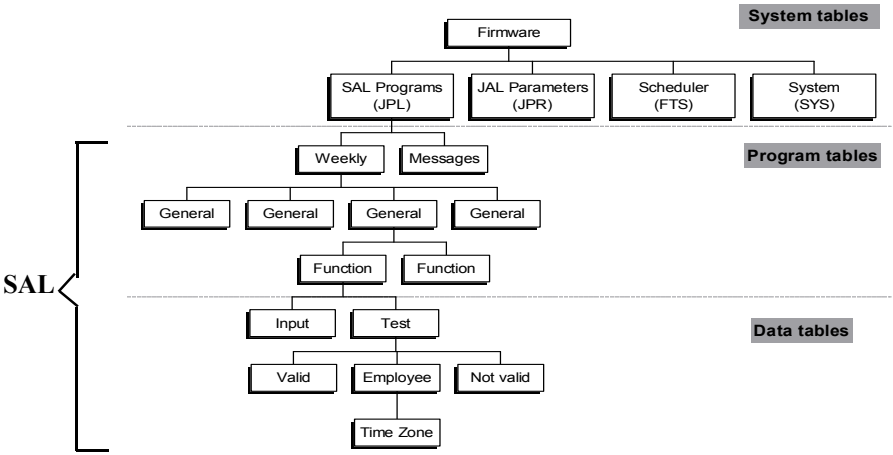
Syncomm programming is a user-friendly tool for building routine access control applications. Synel provides a set of parameters that are logically arranged, stored and were built-in to the program to facilitate Syncomm programming. The global parameters service the entire program and the rest of the parameters are designated to build a corresponding application. These parameters are called by using a special SAL program defined by Synel and are incorporated in Syncomm. The parameters are basically divided into three levels:

- System tables: Firmware oriented parameters.
- Programming tables: Enable planning the activities performed by the terminal as per user functioning requirements.
- Data tables: Contain the authorization for employees, time zones etc.

Table quantity limitation is 31 as each table is a file within the terminal.

2. Tables

Table hierarchy:



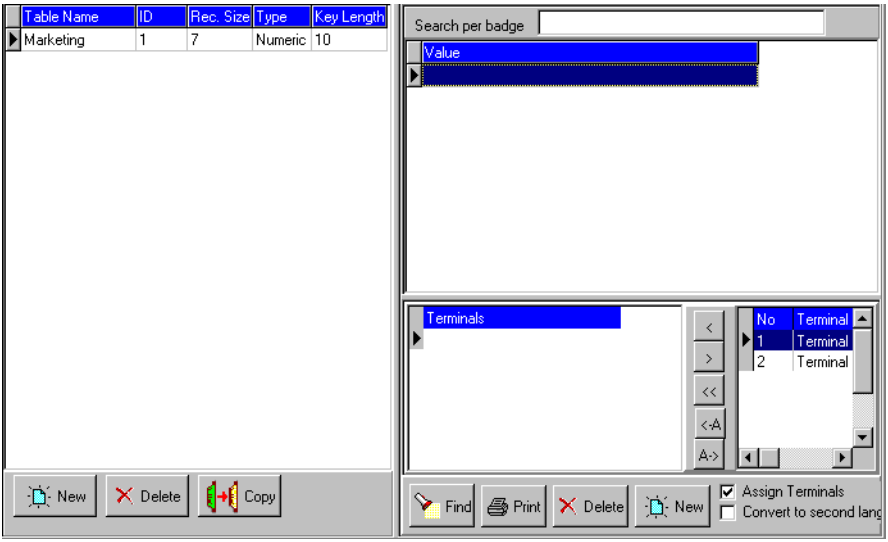
2.1 Data Tables

These table contain actual employee related information such as card number, name, last name etc.

Note: Employee and valid ID must not be identical!

2.1.1 Valid

This table consists of all authorized employee numbers.



Header	Table name	These constitute the header (structure) of the valid table. The data will be filled-in on the right.
	ID	
	Record size	
	Type	
	Key length	

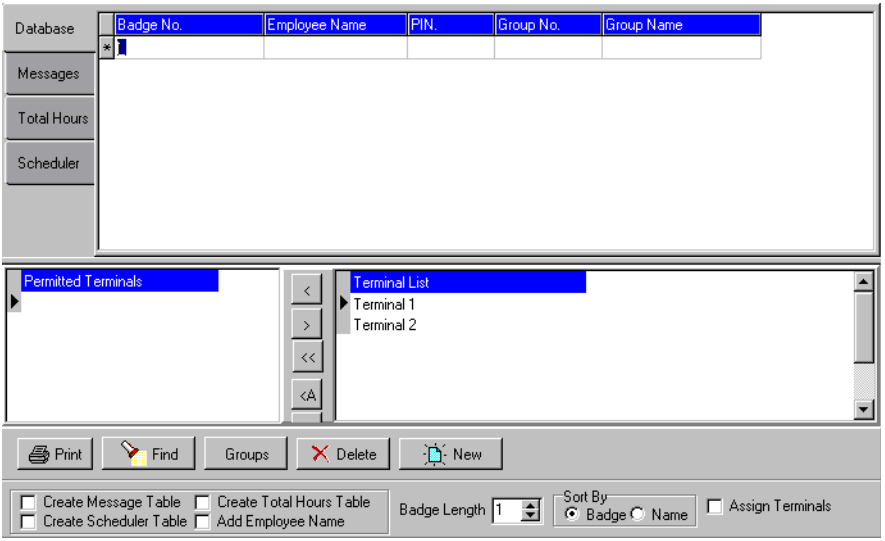
On the bottom the user can allocate permitted terminals to each employee.

2.1.2 Not valid

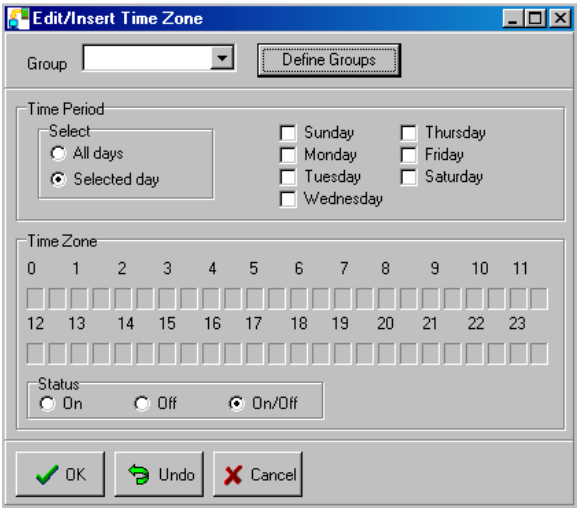
All unauthorized card numbers will be stored under this table.

2.1.3 Employees

A table outlining all employee related details: card number, name, TZ, PIN code etc. In this folder the user can determine terminal authorisations for employee/s.


Database
Messages
Total Hours
Scheduler
Badge No.
Employee Name
PIN.
Group No.
Group Name
Permitted Terminals
Terminal List
Terminal 1
Terminal 2
Print
Find
Groups
Delete
New
Create Message Table
Create Total Hours Table
Create Scheduler Table
Add Employee Name
Badge Length
Sort By
Badge
Name
Assign Terminals

Time Zone


Edit/Insert Time Zone
Group
Define Groups
Time Period
Select
All days
Selected day
Sunday
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Time Zone
0 1 2 3 4 5 6 7 8 9 10 11
12 13 14 15 16 17 18 19 20 21 22 23
Status
On
Off
On/Off
OK
Undo
Cancel

A time frame of 30 minutes during which access is permitted via a specific reader as per a defined employee group.

Step 1: The user must fill-in a number and a group name using the **Define Group** button.

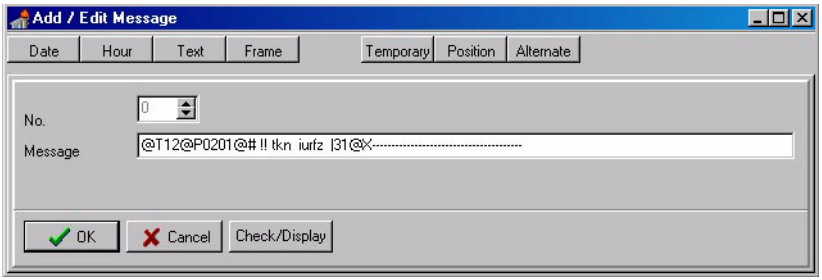
Step 2: mark the relevant day/s and hours and the **Status** radio button accordingly.

Later these time zones will be allocated per employee in the Employee **table.**

2.2 Programming Tables

2.2.1 Messages

The messages list is derived from messages encrypted into the SAL memory. Yet, these messages can be edited using the **Edit Message** button. The following screen appears:

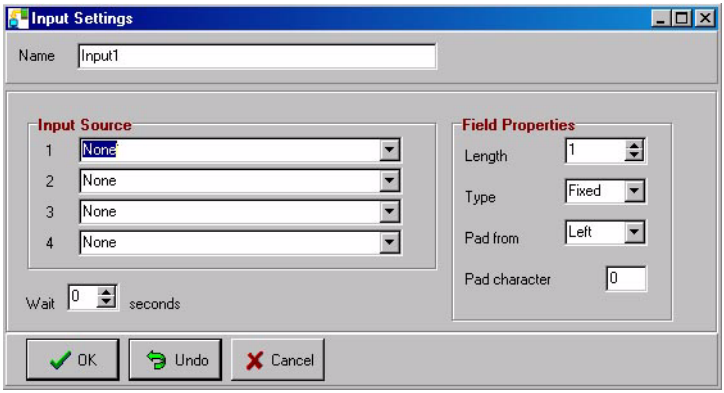


Date	Format	Define the required date format.
	Separator char.	
	Blink for__sec.	Time-out for flashing of date
Hour	Format	
	Separator char.	
	Blink for__sec.	

Text	Text
	Blink for__sec.
Frame	Source type
	Line
	Position
	Filling
	Scroll left
	Cursor left
Temporary	Message flashing time.
Position	Placing message at either line 1 or 2 at a defined offset.
Alternate	Switching display

2.2.2 Input

Define the various types of input devices and their properties corresponding to the function key definitions in the **Transaction** folder.



Field Properties	Length	Input field size.
	Type	Defines if field length will be fixed or not.

	Pad from	Padding direction (when field type is defined as variable and input size is less than field size.
	Pad character	Defines padding character format.

Wait__ seconds- waiting time for this input before reverting to default.

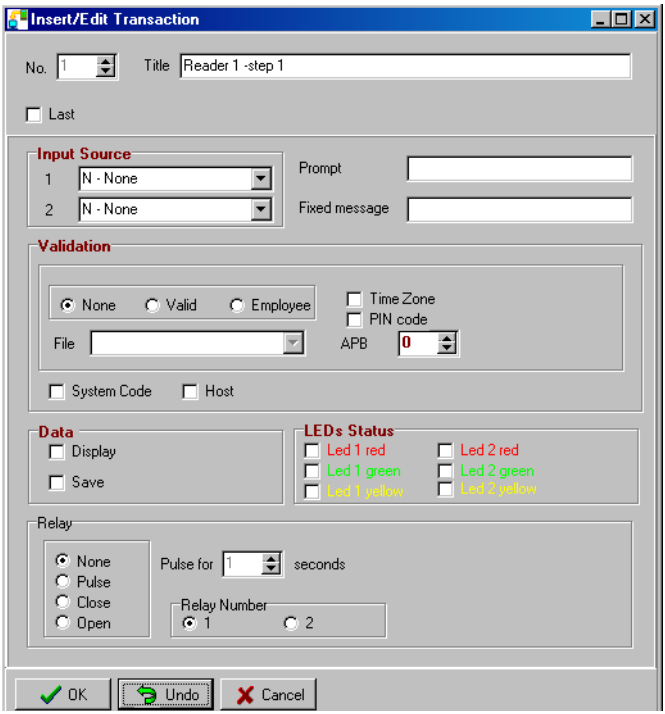
2.2.3 Transaction

All swipe card related hardware activities (per reader or sensor) are managed via this folder. Numerous transaction tables can be defined as follows:

A transaction will be allocated under General| Function keys.

Step 1: Define the name and the transaction table number. Usually in most of application two transaction tables are used: one for working days and another for weekends.

Step 2: Create the 12 records (2 records per entry) by clicking the **Create Function Record** button (bottom of screen). The program allows two steps reporting. The entries are for, Reader 1 or 2, Sensor 1 or 2 and two special function F-1 and F-2.



Step 3: For each record define the fields in the screen above as follows:

Last	Last	Mark this check box if you are using only one step.
Input source	Input source	2 reader/sensors can be used simultaneously.
	Prompt	A programming panel can be connected to the terminal to replace a display panel.
	Fixed messages	A programming panel can be connected to the terminal to replace a display panel for report analysis.

Step 4: Select the required checking method:

Validation	None	No validation is required.
	Valid	Verification of employee card numbers (relatively short record).
	Employee	Verification of all employee related data (PIN code, TZ, APB) (A longer record).
		Time zone: Validity in reference to the time and day of the week
		PIN code: Requires that the employee key-in a individual pin code number.
		APB: After the defined time the Anti-Pass-Back will be activated (in min.) and an employee that has already swiped his card will not be authorized to do so a second time. When APB value is 0 - it is not active.
	System code	A general code usually encompasses all company employees. Must be defined in the **General** folder.
	Host	On-line validation of a card that was just swiped.

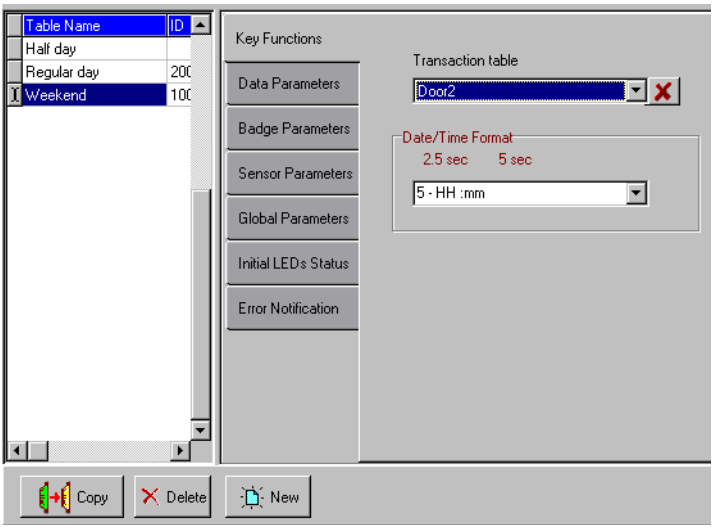
Additional hardware data

Data	Display	After swiping the card the prompt message will be displayed.
	Save	Mark this check box to save this transaction.
LEDs Status	Upto 2 LEDs and a buzzer can be used per reader. Mark the relevant check box for operation.	

Relay	None	Do not activate relay.
	Pulse	Open relay for a very short time.
	Close	Close relay.
	Open	Open relay for an indefinite time.
	Pulse for..	Open relay for a predefined time interval (in sec.)
	Relay number	Which relay will be activated.

2.2.4 General

This folder encircles all elements that constitute terminal activities (hardware and data management) and definitions.

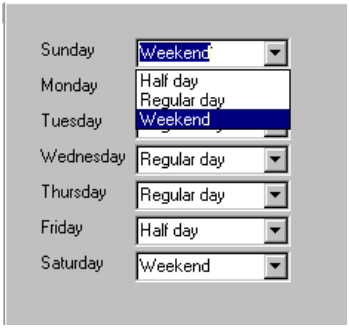


Function keys	Transaction table	Assign the defined transaction table definitions to all function keys.
	Date/Time Format	Assign a Time/Date format to all function keys

Data Parameters	PIN retries	The number of times the user will be allowed to key-in the pin code without being rejected.
	Wait	Waiting time before retries (in sec.).
	Wait	Query: Waiting for reply from host.
	Save time	Save time recording (Wait)
Badge Parameters	Field Properties	Total card length definition
	Constant Value Check	System number offset and length
	Define Sub-Field check	Location of a list verified data within the card number string.
	Define Sub-Field save	What data from the card string will be stored.
Sensor Parameters	Polarity	Normally open/closed mode.
	Debounce	Time until the sensor is reactivated (1-9).
	Notify when polarity	The SAL will be in WAIT mode for the chosen parameter. Once notification from the terminal is received the SAL will quit WAIT mode. Later this data can be retrieved.
Global Parameters	Type	Assign a reader type to a function key.
	Number	Fill-in the reader number (00- for internal/ left side reader, 01- for external right side reader).
	Transaction code	Fill-in a transaction number after data was collected.
Initial LEDs Status: Initial idle mode per reader		
Error Notification	Message	LED mode when an error occurs, and what message will be displayed on the prompt.

A General table will be allocated to a day of the week in the Weekly folder.

2.2.5 Weekly



The weekly folder is designated for assigning a **General** definitions table to a weekday.

2.2.6 Test

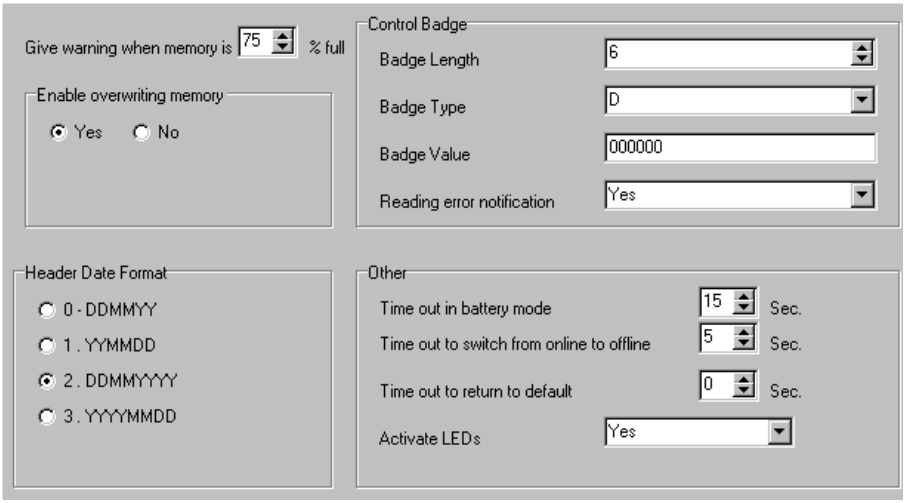
2.3 System Tables (Controlled by the firmware)

2.3.1 Day Light Savings

The SY780A can be programmed to automatically move the clock backwards by one hour (Fall) or forward by one hour (Spring) at given dates to obtain maximal use of daylight.

2.3.2 System

Setting memory/control badge/battery and other parameters as follows:



Memory	Warning	Alert when dynamic memory is full x %.
	Over-writing	Enables over-writing transactions that were collected and not cleared.
Header Date Format: Transaction header date formats.		
Control Badge	Length	Technician card digit string length.
	Type	Classified per access control level.
	Value	Technician badge number.
	Reading error notification	Y = SAL receives badge reader error reply from terminal. N = Reply omitted (in the terminal = default)

Other	Time-out in battery mode	Time the terminal reverts to battery mode in case of a power supply shortage. 99 value- the terminal will work until the battery is empty.
	Time-out from on-line to off-line	When there is no communication between terminal and host the terminal initially waits the defined time-out before switching to off-line mode.
	Time-out to return to default	Time to revert to default function (set in Scheduler).
	Activate LEDs	Control panel keyboard leds operation.

2.3.3 Scheduler

The Scheduler enables setting a time table for all function keys, relay operation and modems for a specified day of the week at a specified hour.

2.4 Table Structure

Synel's terminals have a unique fixed system table format. These tables are handled directly by the firmware. The table's header contains all relevant data (informative, structural).

Synel's terminal has a special format for internal tables (files). The table contains a header that determines its general information and structure, and data records. The table can be divided into two groups: Tables that are handled directly by the firmware and user defined tables.

Header structure

Byte	Length	Value	Type	Explanation
1	1	A-z	A&N	Table type – Used as part of file identification
2	3	001-999	N	Table ID – for file identification

Byte	Length	Value	Type	Explanation
5	5	00023-z9999	SN	Total table characters
10	1	0-z	A&N	Version of table
11	2	23	N	Header Size
13	2	00-99	SN	Record size - total number of characters in a record
15	3	000-z00	SN	Number of records in table
18	2	00-	N	Key length
20	2	00	N	Key offset (a fixed value - not in use).
22	2	00-03	N	00 – Not sorted, not packed 01 – Not sorted, packed (Only in numeric records!) 02 – Sorted, not packed 03 – Sorted, packed

A&N- Numbers and characters are allowed in this field.

N- Numeric field

SN- Special Numeric field. This format is used in order to increase the value range in a numeric field without increasing the size of the field for compatibility. The algorithm is simple, there is no change in the least significant bytes of the number, and only the most significant byte of the number is changed to a character according to the following algorithm:

10 is represented by ":", 11 ";" etc. according to the standard ASCII table.

For example: If the records total in a table is 2049, then it will be converted to E49. (See algorithms in appendix –A).

In a sorted table the records are in incremental order as per the defined field key. The sorted table search is a binary search, therefore there must not be a duplicate of the same record with the same key. In such cases add a digit to the key to make it unique.

A pack table must consist of numeric characters only. Compression is simple, the terminal will store 2 digits in one byte by converting ASCII into BCD.

The compression ratio is 1:2. There will be no data record merging. In odd record length the last nibble will be empty.

System tables

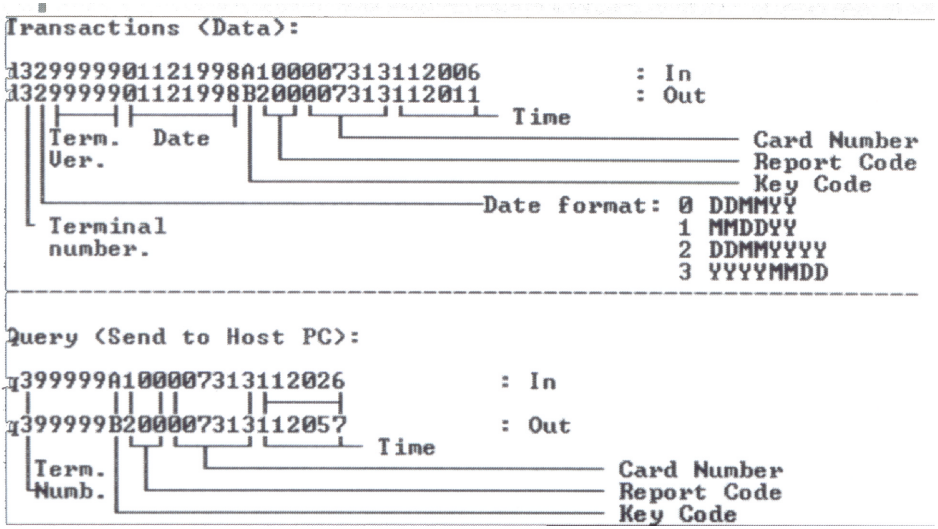
System tables are handled directly by the firmware. The structure of the table is constant, however the number of records is not constant. There are 5 System tables: Task Scheduler Table (FTS), Messages table (MPL), System Parameters Table (SYS) and Program tables like JPL & JPR.

Header of system tables

Field	**Valid**	**Non Valid**	**Employee**	**TZ**	**Weekly**
File name	Vid	Non	Emp	Vzn	Wkd
Table type	v	u	v	d	d
Table ID	As defined	As defined	As defined	994	996
Total characters	*	*	*	*	00044
Version	A	A	A	A	A
Header Size	23	23	23	23	23
Record size	---	---	Key length+ 10	53	03
Number of records	---	---	---	---	007
Key length	As defined	As defined	As defined	05	00
Key offset	00	00	00	00	00
Attributes	02	00	02	02	00

* - Header size + (Record size x number of records)

2.5 Transaction structure



Synel Industries Ltd.
2 Hamada St. POB 142, Yokneam Industrial Park, Israel, 20692
Tel: +972-4-959 6777 Fax: +972-4-959 0729
Site: www.synel-ind.com
Tel-Aviv Branch Tel: +972 9 775 0400
UK Branch Tel: +44-181-900 9991
NA Branch Tel: +1-905-678 2605