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Operating Manual

XPM 80™
Thermal Printer Family

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1. Introduction

Thank you for selecting the Hengstler XPM 80™ thermal printer! We are proud of this feature-rich product, which was designed using all our expertise and experience, and we are confident that you will be pleased with the advanced features and outstanding performance.

This Operator Manual is designed to help you with the proper installation, connection to your host computer system and start-up of the XPM 80™ thermal printer system. All necessary details will be explained in the following sections. Please read this manual carefully before using the printer. If you have any further questions, please do not hesitate to contact us.

The XPM 80™ thermal printer family does not require any servicing and is intended primarily for printing and cutting documents and receipts from continuous thermal paper. The XPM 80™ handles paper with a width of 55 to 86 mm. A cutter is standard and is integrated into every XPM 80™ print mechanism. Powerful motors allow the use of large paper rolls to maximize time between paper replenishment. 'Black Mark' control is available for when documents are to be printed on preprinted forms or with a predetermined length. Models with horizontal and vertical print density of 203 can be provided so that graphics, such as logos etc. can be printed with excellent quality.

The XPM 80™ printer family has been designed for use primarily in transit and similar ticketing applications. Its robust design makes it a natural choice for such heavy-usage.

Equipped with either USB or Serial (RS-232) interfaces, the XPM 80™ printer family is one of the most versatile we've ever produced! Driver software is available that supports the Windows XP and Linux operating systems. In addition, these printers can also be activated directly through ESC sequences; a detailed description of the different native commands is contained in the XPM 80™ Emulation Command Set Reference.

We're glad you chose the XPM 80™ thermal printer family. Once you've used it, we're sure you will be, too!

1.1. Additional Documentation

Document No.	Description
D 690 004	XPM 80™ Emulation Command Set Reference
D 690 005	XPM 80™ Windows® XP Driver Manual
D 690 008	XPM 80™ Linux Driver Manual
D 690 112	XPM 80™ Paper Specification
D 690 021	XPM 80™ Dimensional Drawing

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2. Important Information and Safety Instructions

Hengstler GmbH accepts no liability for any damages, direct, indirect or consequential, arising from improper use of this thermal printer, and, in particular, due to non-compliance with this operating manual or any other available documentation or due to improper handling or maintenance. Should Hengstler GmbH choose to make technical documentation available, this does not imply any authorization, implied or stated, for the making additions, repairs or modifications to this printer.

This documentation may not be copied, nor shall its contents be disclosed or used commercially unless such use has otherwise been explicitly agreed to by a duly authorized Hengstler representative in writing.

The user is responsible for proper handling and installation of this printer. The printer should only be shipped in its original packing.

2.1. General Information

Hengstler GmbH accepts no liability for the safe operation of the XPM 80™ thermal printer family unless Hengstler original products are used exclusively and the following instructions and recommendations are heeded.

☞ If unauthorized persons perform any repairs or modifications to the printer mechanism and the controller, HENGSTLER does not accept any liability and the guarantee shall be void.

☞ Unapproved types of thermal paper may dramatically reduce the life of the printhead and may void the warranty. For pre-printed thermal paper make sure that only appropriate inks are used. Detailed can be found in the Hengstler Paper Specifications document D 689 112.

☞ The DC power connector must not be plugged in or disconnected under load in order to avoid damage to the electrical components and the thermal printhead.

☞ Avoid strong vibration, shock and impact since they may damage or destroy sensitive electronic and mechanical components. Do not touch the surface of the printer control board in order to prevent static electricity from damaging sensitive components.

☞ This thermal printer must not be used near high-frequency apparatus or strong magnetic fields in order to prevent undefined magnetic disturbance.

☞ Do not make any attempts to service this printer (e.g. change paper) while the printer is printing.

☞ Installing or uninstalling the printer must only be done while using adequate ESD protection.

2.2. Systems Specific Safety Instructions and Symbols

The following symbols on the system and in the manual remind you to follow the relevant safety instructions:

⚠ General warning for cases where the user or a service person may be in danger.

☞ General notes and hints for operating the system safely.

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3. Overview

3.1. Overview of Thermal Printing Technology
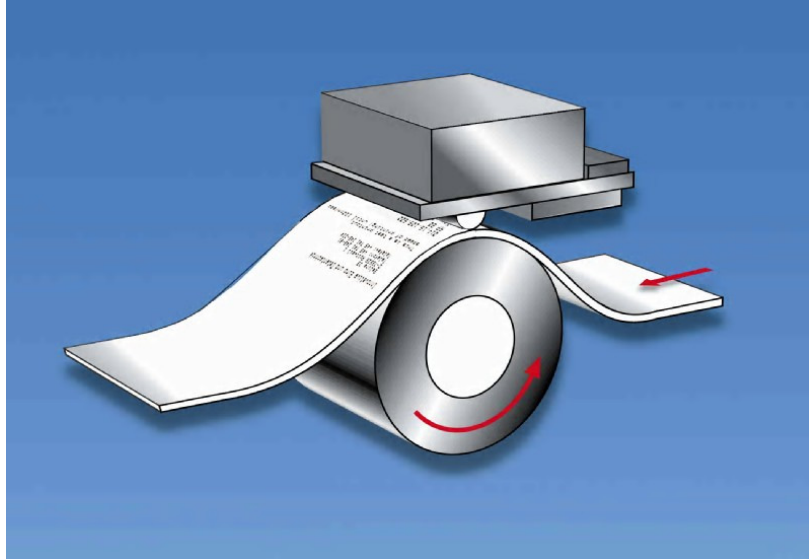
A brief overview of thermal printer technology might be helpful to understand how the XPM 80™ thermal printer family works. In most direct thermal printers, paper is fed over a soft, rotating platen and under the thermal printhead. The platen acts as a roller to advance the paper, and at the same time acts as a surface against which the spring-loaded printhead presses the paper to insure good thermal conductivity. Circuitry in the printer determines which heating elements to activate ("fire" or "burn") to form the next row of dots on the paper.

The thermal paper is coated with several compounds. At room temperature, these compounds are white in color and do not react with each other. The heat from the thermal printhead acts as a catalyst in the areas where the small printhead dots are fired, causing these compounds to react with each other and form a new compound which is a contrasting color, usually black. The platen then advances the paper to the position of the next dot row, and the process is repeated.

You may note immediately several of the advantages of thermal printing. First, since the printing is done with heat, there is no noise from the printing process itself. Thermal printing is inherently quiet compared to most other technologies, such as impact dot matrix. Also, there is only one moving element in the thermal printer: the platen. This provides increased reliability and life when compared to other technologies. Since the chemistry of the thermal paper itself is what causes the printing to appear, there is no replenishment of ink ribbon, ink cartridges or toner. This makes thermal printing the least maintenance-intensive of all common printer technologies.

3.2. Functional View
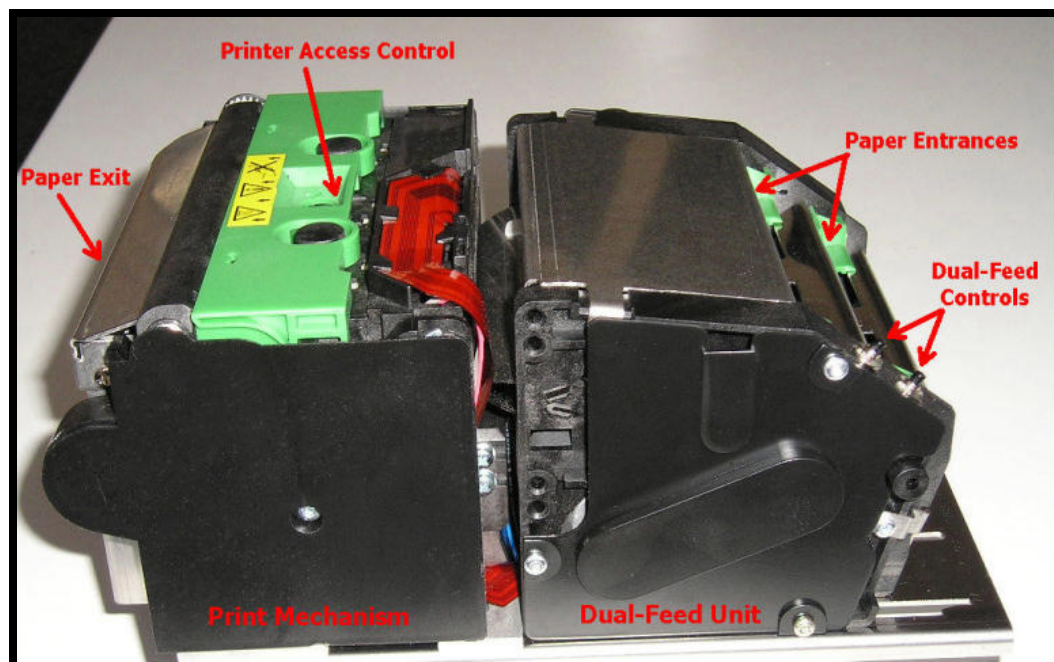
Figure 1
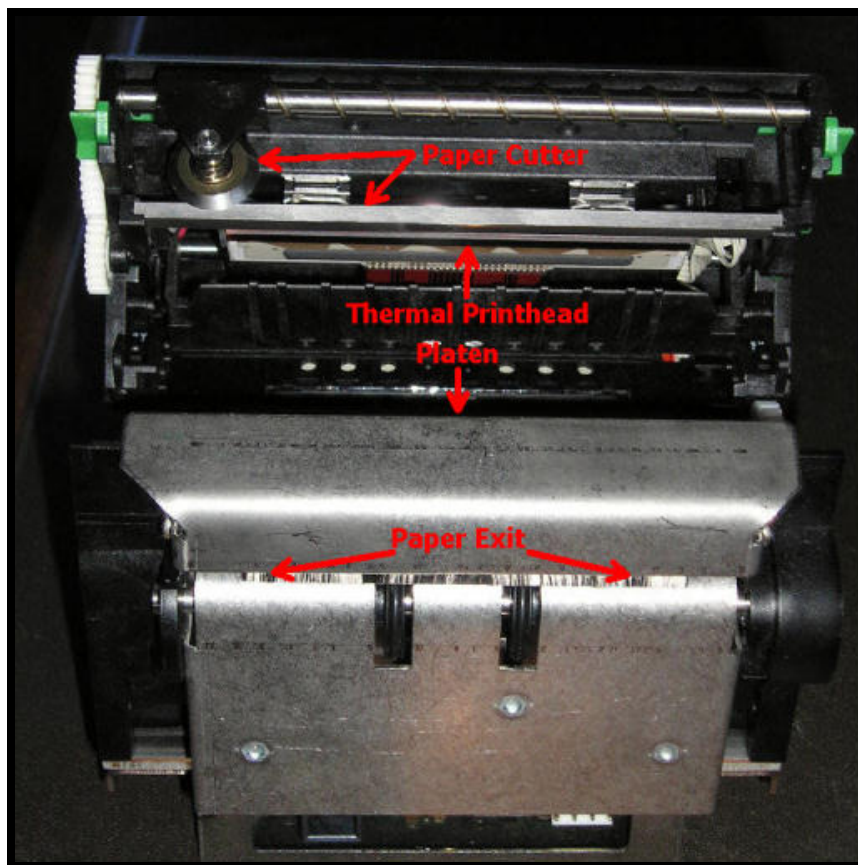
Figure 2

3.3. Description of Components and Operation

There are several key components or modules to the XPM 80™ family of thermal printers. (Please refer to Fig. 1, which shows an XPM 80™ with dual-feed unit, and Fig. 2, which shows the same printer with the print mechanism open.)

The thermal printhead is positioned above the platen. With the print mechanism closed, the platen acts as a roller to advance the paper at the same time as it acts as a surface against which the spring-loaded printhead presses the paper to insure good thermal conductivity. The interface, motor used to turn the platen, sensors, printhead, dual-feed motors and paper cutter are all connected to the controller, located in the shallow, metal housing under the printer, which sends commands and causes these components to function at the proper time. The cutter separates the paper from the paper supply when instructed to do so. Several sensors monitor progress as the printed document is created. All these items are mounted to electrically-conductive mounts to discharge any static and to provide electrical noise shielding.

When paper is inserted into the dual-feed unit, the entrance sensor detects its presence and signals the controller. The controller causes the appropriate dual-feed paper advance motor to turn its roller to draw paper into the dual-feed unit (DFU) and advance it to the printer. The paper will stop in the printer park position as defined by the XPM Configuration Tool. The printer is now ready to print. The XPM 80™ will automatically select the last paper inserted as the paper to be printed. As a result, when one paper path is already loaded and paper is inserted into the empty paper path, the loaded paper path will reverse the paper and remove it from the printer, stopping it inside the DFU at the DFU park position. The paper being loaded will advance to printer park position.

The paper to be printed is selected either by software command or via the Dual-Feed Control pushbuttons. When the paper path to be printed is selected, the paper presently in the printer park position is retracted into the dual-feed unit, and the newly selected paper advances into the printer.

When data is sent to the printer and printing begins, the paper is advanced by the printer platen as the individual heating elements of the thermal printhead heat as necessary to form the printout. The selected paper path's DFU motor advances at the same rate to provide a smooth, continuous feed. The paper continues to advance and enters the paper cutter area, where it passes over the fixed cutting blade and out the front. Once printing is completed, the paper is advanced and a command sent to the cutter to cut off the paper. The paper can then be retracted to a park position to avoid wasting the paper between the printhead and cutter.

When the printer runs out of paper, the printer entrance sensor detects the fact. How the printer reacts next depends upon the printer's settings. One common selection is for the printout to be invalidated (printed over to make it illegible) as it is retracted out the back of the printer. Depending upon how the printer has been programmed, it may then switch to the alternate paper roll (either automatically, via software command, or by use of the Dual-Feed Control), allowing printing to continue. A replacement paper roll may then be loaded into the unoccupied paper path of the dual-feed unit.

3.4. Location of Controls and Connectors

Please see Figures 3, 4 and 5 below for the location of connectors, indicators and controls on the XPM 80™ series.

⚠	**Caution!** Care must be taken to avoid injury due to the sharp cutter components when the print mechanism is open.

⚠	**Caution!** The printhead may be hot from printing that took place shortly before opening the print mechanism and may represent a burn hazard. Care must be taken to avoid touching any hot surfaces.

Figure 3 shows a top view of the print mechanism, and identifies the Printer Access Control. By pulling the recess in the direction shown, access can be gained to the paper path, printhead, platen and cutter as shown in Figure 2 above. To close the print mechanism, press down on the black area below the label until the upper print unit snaps closed.
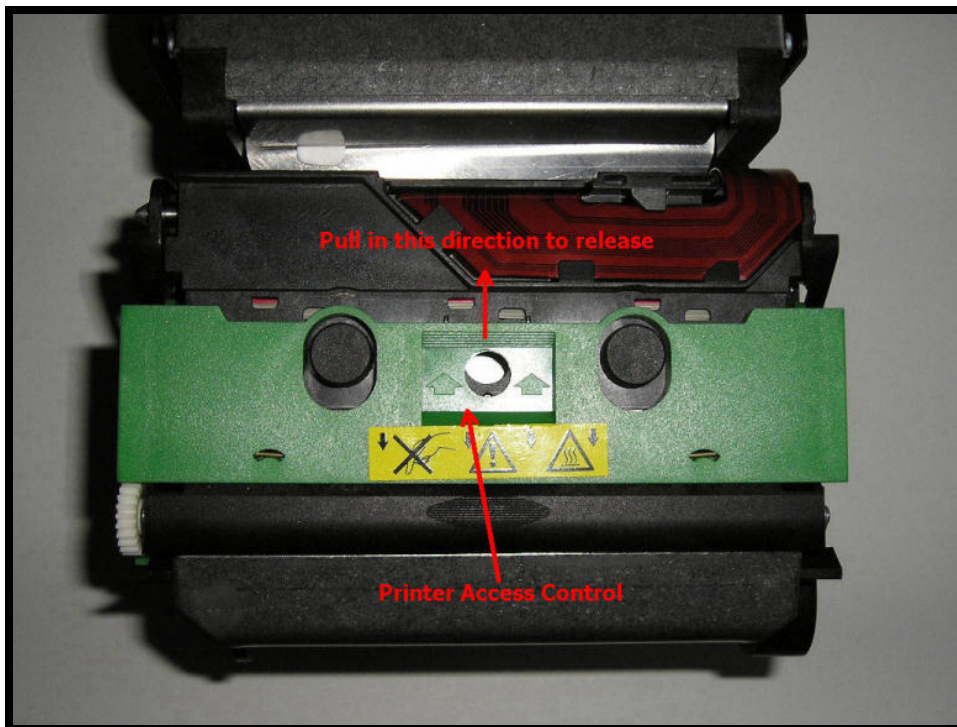
Figure 3

Figure 4 shows the electrical connections for the XPM 80™, which are located beneath the print mechanism. (This location is referred to as "Side A".) These consist of the USB interface, the serial (RS-232) interface, the paper pre-end and weekend sensor inputs for both paper paths, and the power connection. In some versions of the XPM 80™, these connectors may be duplicated on the opposite end of the printer under the dual-feed unit. (This location is referred to as "Side B".)

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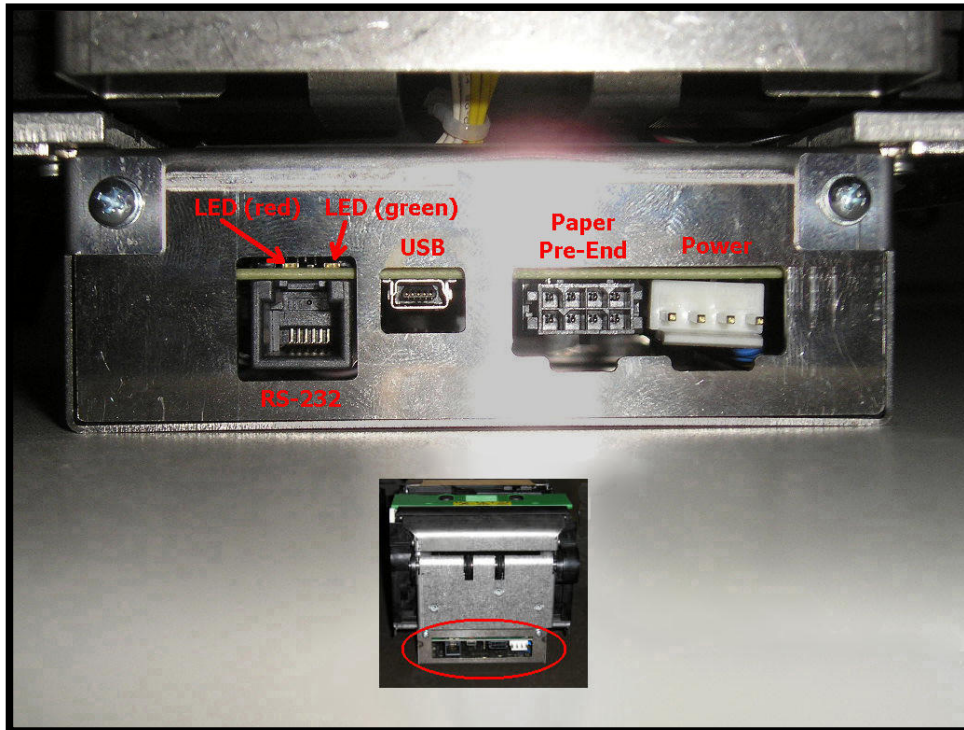
Figure 4

Figure 5 shows the Dual-Feed Unit (DFU). The Dual-Feed Controls are used to manually select which paper path is to be used, and to eject the paper from that path. The paper path may also be selected under software control, or automatically when one paper source is exhausted. The Dual-Feed controls may also be disabled by the printer configuration to prevent manual manipulation of paper usage.

The Paper Guides can be adjusted by loosening the screws that lock them in position and sliding them to the proper location. Please note that it is important at all times for the paper path to be straight. Care must be taken that the paper guides cause the paper to line up properly with the paper roll holders or the fanfold source. A crooked paper path will increase the likelihood of paper jams. The paper path should also be centered in the printer to ensure optimal operation.

All other user-adjustable functions and settings in the XPM 80™ are controlled by the supplied software tools.

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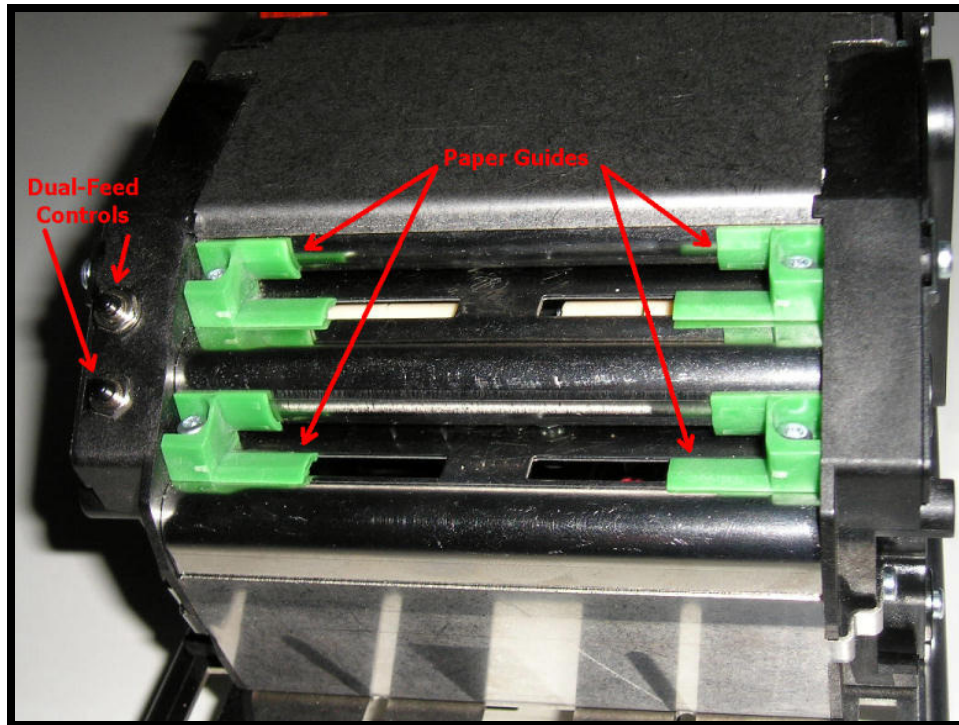
Figure 5

3.5. Operation of Controls, Sensors and LEDs

3.5.1. Dual-Feed Controls

Two pushbuttons are mounted on the Dual-Feed unit and control its operation. (Please note that these pushbuttons can be disabled through the XPM Configuration Tool to prevent manual intervention with the paper path selection process.) Once paper is loaded in both paper paths, the controls have the following functions.

- **Press and release control for selected path:** Paper is placed in DFU park position. (Neither paper path is selected; printer reports out of paper.)

- **Press and release control for unselected path:** Paper for that path is loaded into printer. Printer reports "ready to print".

- **Press and hold control for selected or unselected path:** Paper for that path will eject from back of DFU. Paper will have to be fully removed to clear paper sensor and then reinserted before it can print. Printer will report out of paper if that path was the selected paper path.

3.5.2. Dual-Feed Paper Guides

There are two paper guides (one left and one right) for each of the two paper paths in the DFU. These should be adjusted to properly guide the paper into the DFU. It is important that the paper be centered in the paper path inlet to ensure the most reliable, jam-free operation.

To adjust the paper guides, loosen the single screw in each until the guide will slide, position it in its desired location, and tighten the screw.

3.5.3. Upper and Lower Paper Path Entry Sensors

These sensors detect the presence of paper when it is inserted into the upper and lower paper paths of the Dual-Feed Unit (DFU). The controller uses this information to load paper and to determine whether paper is present in each of the paper paths.

3.5.4. Upper and Lower Paper Path Exit Sensors

These sensors detect that paper is exiting the DFU, and are part of the jam detection and control logic system. One function is to determine if paper has been retracted from one paper path before advancing the paper from the other path into the printer.

3.5.5. Paper Entrance / Black Mark Sensor

There is a sensor in the paper entrance area of the print mechanism that serves several functions. First, it detects paper entering the print mechanism and signals the controller to activate the paper advance system. Similarly, when the printer is out of paper, this sensor detects the fact and signals the printer accordingly.

The same sensor is also used to detect Black Marks. Black Marks are blackened areas placed on the paper during the converting process. They are generally used, in conjunction with appropriate printer commands, to advance the paper to a specific position after each print job. One common reason for this is to so that preprinted information is properly located with respect to information printed by the printer itself, for example, printing inside a preprinted box. Black marks must be located on the back (non-coated) side of the thermal paper.

The XPM 80™ printer is designed to allow for numerous Paper Entrance/Black Mark sensor locations during manufacturing. (The location of this sensor cannot be changed once the printer is built.) Also, two different sensor types can be used. The most common is the reflex or reflective sensor, where the light source and detector are located on a single chip. Basically, the light strikes the white paper surface and reflects back into the sensor. If enough light reflects to activate the sensor, the printer reports that paper is present. If there is not enough light reflected, the printer assumes that this area is black, meaning the printer is on a black mark or the printer is out of paper. There are seven (7) different possible positions for this sensor. The positions of these sensors are detailed in Figure 8.

The XPM 80™ can also use a through-beam sensor. This type of sensor has a separate light source and detector. The light is transmitted across the paper path into a prism, which redirects it back across the paper path into the detector. When the light is blocked and cannot reach the detector, the printer reports that paper is present. When the light does reach the sensor, the printer concludes that there is no paper present.

The through-beam sensor can also be used in a manner similar to a Black Mark sensor. Instead of a Black Mark, a hole is used in the paper. The through-beam sensor is located in one of seven (7) different possible locations; the centerline location of the paper path is the default. The positions of these sensors are detailed in the Figure 9.

3.5.6. Head Status Sensor

An additional Head Status Sensor is used to determine whether the printhead is in the up (do not print) or down (ready to print position). Normally, most of the heat generated by thermal printing is transferred to the paper being printed and is removed from the printer as the paper advances. When the printhead is up, no heat is being transferred to the paper and the heat remains in the individual dots, allowing them to overheat if activated repeatedly. Because this may cause permanent damage to the printer, the XPM 80™ firmware will prevent printing or paper loading if the head is up.

The output of this sensor is also available from the Query function. See the XPM 80™ Emulation Command Set Reference D 690 004 for details on determining the printhead position and the printhead temperature.

3.5.7. Cutter Sensors

The XPM 80™ uses a "pizza-cutter" style paper cutter. A cutting disk moves from one side to the other to sever the paper from the roll against a stationary blade. Sensors are located at the end of travel for this cutter so the controller can detect where the cutter blade is and determine in which direction it should be moved to cut the paper.

3.5.8. Paper Exit Sensor

A sensor on the exit side of the print mechanism detects when paper has passed through the cutter assembly and reached the paper exit.

3.5.9. Paper Pre-End (Paper Low) Sensors

The XPM 80™ has inputs for four sensors indicating Paper Pre-End (Paper Low). There is one set of sensors (one for the upper paper path and one for the lower) to detect standard Paper Pre-End (PPE). Connected to appropriately selected sensors, these will signal via a query through the interface when paper has become low enough to activate this signal. These two inputs are analog sensor inputs that are converted to digital signals via analog to digital (A/D) conversion. Therefore, it is possible to read their analog values and use this information as a measure of sensor obstruction.

The second set of sensors are also for Paper Pre-End, but are intended for use as what are commonly called "weekend sensors" (PWE). While the standard PPE sensors detect when paper has reached some user-defined point where a paper change will be required shortly, PWE sensors are usually set to signal whether there is enough paper remaining to make it through the weekend without replenishing the paper. This is especially useful for installations where the smaller staff that is available on weekends may not be trained in paper replenishment. The PWE inputs are direct digital inputs. Since no supply is provided to power an LED-style sensor, these inputs are best used with a microswitch.

3.5.10.   LED Indicators

There are two LED indicators in the XPM 80™ series printers, located as shown in Fig. 4. These LEDs are used to signal some status information concerning the XPM 80™ printer. The following is a partial listing of the information supplied.

There are several flashing speeds used in the XPM 80™ printer LEDs. These are:

▐ Slow: 0.5 Hertz (LED is "on" for one second and "off" for one second)
▐▌▌ Medium: 1 Hz ("on" for .5 seconds and "off" for .5 seconds)
▐▌▌▌▌ Flicker: 10 Hz ("on" for 50 ms and "off" for 50 ms)
☐ Off
■ On

Red LED	Green LED	Meaning
☐	▐	Printer operational, paper available, not printing
☐	▐▌▌	Printer operational, paper available, printing
☐	▐▌▌▌▌	Printer operational, out of paper
■	▐▌▌▌▌	Exchanging data (firmware, fonts, logos, etc; writing to flash
■	▐▌▌▌▌ ☐ ▐▌▌▌▌	Printer not operational due to printhead open, wrong configuration , wrong voltage or hard reset
■	▐▌▌▌▌ ☐ ■ ☐ ▐▌▌▌▌	Print mechanism jammed
■	▐▌▌▌▌ ☐ ■ ☐ ■ ☐ ▐▌▌▌▌	Cutter jammed
■	▐▌▌▌▌ ☐ ■ ☐ ■ ☐ ■ ☐ ▐▌▌▌▌	Feed unit jammed
■	▐▌▌▌▌ ☐ ■ ☐ ■ ☐ ■ ☐ ■ ☐ ▐▌▌▌▌	Presenter jammed
▐▌▌▌▌ ☐ ■ ☐ ■ ☐ ▐▌▌▌▌	▐▌▌▌▌ ☐ ■ ☐ ■ ☐ ▐▌▌▌▌	Fatal error; SDRAM defective
▐▌▌▌▌ ☐ ■ ☐ ▐▌▌▌▌	▐▌▌▌▌ ☐ ■ ☐ ▐▌▌▌▌	Fatal error; Board type cannot be identified
■	☐	Probable system stall during initialization phase
■	■	Probable system stall during boot phase

Please note that much more detailed information concerning the printer's current state can be obtained by requesting the printer's status via the interface. Please refer to the XPM 80™ Emulation Command Set Reference D 690 004 for details.

3.6. Graphic Printing vs. Printing with Printer's Fonts

One area that causes frequent confusion with regard to printers in general is that of graphic printing versus printing using the printer's internal fonts. An explanation here may help clarify this and make application of the XPM 80™ easier for you.

All printers contain a set of commands that will cause the printer to perform different functions. (For the XPM 80™ family of thermal printers, these commands are documented in the XPM 80™ Emulation Command Set Reference, P/N D 690 004.) The functions are very diverse and there are no standards for what these functions may be. This allows printer manufacturers to innovate and build unique features into their products. These commands are often referred to as the printer's "Native Commands".

A printer's Native Commands are of many different types, but a few are of particular interest to us here. One is the family of commands for printing graphics. It is these commands that allow pictures and other graphic images of any type to be printed.

Another family of commands of interest to us here is the text commands. These commands involve printing text in response to ASCII data sent to the printer. The printer itself contains one or more character sets. In these character sets, one printable character corresponds to one ASCII character. There are also commands for positioning and modifying the printout from these character sets, such as tab and indent commands and commands to enlarge the internal character set by some factor.

When printing from the internal character sets (we'll call that "ASCII printing" here for convenience), characters are sent to the printer and the corresponding characters from the character set are printed. This has both advantages and disadvantages. The biggest advantage is that the host need only send one character per printed character. So if 40 characters are being printed on a line, for example, only 40 bytes of data (plus any overhead for formatting, indenting, etc.) need be transmitted over the interface. In other words, you can print a lot of text and need send only a little data. The downside is a lack of flexibility. In today's Windows® world, we are all used to printing exactly what we see on our computer screens, in the same font, size, etc. as we see it. But with ASCII printing, what will be printed will be based on the printer's internal character set.

The other type of printing we'll call "Graphic printing". This is what happens when you print to an ink jet or laser printer from your PC. The information displayed on the screen is sent to a print driver. This print driver, which is unique for each printer, translates what is on the screen as a graphic into graphic Native Commands to be sent to the printer. **Everything printed through a print driver prints as graphics**. It takes a lot more data to transmit graphics than to transmit ASCII. In our 40 character example, assuming a 12 x 20 pixel character, the Hengstler XPM 80™ printer would require 1,600 bytes to print one line. (Please note that these are estimates, and that various compression routines also impact the print speed.)

The advantage of Graphic printing, then, is the ability to print anything; pictures, text, photos, etc. exactly as you see it on your screen. The disadvantage is that to do so, much more data (40 times as much data in our example) must be sent over the interface.

As a practical matter, then, it comes down to this. If you are doing ASCII printing, you can use USB or a serial interface. Both are fast enough to handle the smaller amount of data being sent. But if you are doing Graphic printing, USB is a far better choice due to its higher speed, and serial may increase the time to complete a printout to an unacceptably long period.

4. Unpacking

Care should be taken when unpacking your XPM 80™ printer to preserve the packing material for possible future use. XPM 80™ packing is specifically designed to protect the printer from damage in the harsh environment of trucks and aircraft. Please be sure to use this packing if it ever becomes necessary to reship your XPM 80™ unit.

5. Major Options

5.1. Barcode Scanner Option

XPM 80™ printers can be supplied with an optional barcode scanning feature. The purpose of this option is to scan preprinted barcodes on the non-coated (back) side of the printout. The latest scanned barcode is stored in the printer memory and can be read out through the printer interface via a query command. See the XPM 80™ Emulation Command Set Reference D 690 004 for details on reading the data from the printer.

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6.   Installation

6.1. Function

Please note that the XPM 80™ printer is a module designed to be integrated into a system and to be operated only as a part of that system, for example, in a kiosk. All technical specifications and instructions contained in this manual and related documentation must be considered and complied with in order to achieve successful operation in the completed system.

6.2. Mounting Printer

The XPM 80™ printer is designed to be mounted in a vertical orientation (with printout exiting downward, towards the ground). This vertical orientation allows gravity to help the severed ticket fall directly into a chute or receptacle of the customer's design.

Mounting is by means of a series of hooks fabricated into the device to which the XPM 80™ will be mounted. These engage four slots in the printer frame (see Figure 7). Due to the wide variety of different mounting possibilities and egress systems in the user's application, it's not possible to offer one universal mounting system. Figure 7 shows a sketch and photo of the mounting slots on the XPM 80. Please see drawing D 690 021 for details.

Figure 7

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6.3.   *Wiring*

6.3.1. Power

Power is connected to the XPM 80™ thermal printer via a JST connector.   The connector consists of a JST VHR-4N shell and two SVH-21T-P1.1 contacts. Wiring is as follows:

Pin	Function
1	Ground (0 VDC)
2	Ground (0 VDC)
3	+24 VDC
4	+24 VDC
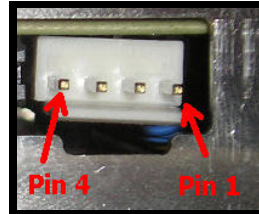
6.3.2. Interfacing

Please note that the XPM 80™ comes with both USB and RS-232 serial connectors installed.   Only one interface is selected for data communication with the printer, based on how the printer was ordered and configured before shipment.

Also, please note that in some versions of XPM 80™, the USB, RS-232 serial and PPE connectors may be duplicated on Side B, under the Dual-Feed unit. If this is the case, only the Side A or the Side B interface connector may be used, not both. See the section "Paper Pre-End" for details concerning use of two PPE connectors.

RS-232 Serial

The serial versions of the XPM 80™ printer are shipped with the following RS-232 serial settings as default: 115,200 baud, 8 data bits, one stop bit, no parity, hardware flow control, and host transmission not blocked. (This last feature is intended for use with lower sophistication hosts that cannot read the XPM 80™ printer's status data. It uses the hardware handshake lines to prevent the host from sending more data if the printer registers "paper out".)

☞ **Note:** If the particular XPM 80™ model is equipped with the barcode scanner option, the RS-232 port is then dedicated to communication with the barcode scanner and only the USB interface may be ordered for printer communication.

The serial interface uses a standard RJ-12 connector to make the RS-232 connection. Hengstler can provide a serial cable for direct connection to PCs with a DB-9 connector on one end. The wiring is as follows, should it be necessary to fabricate such a cable. Cable length must be limited to under 3 meters.

Serial Pinout

DB-9 Female Pin Number	RJ-12 Pin Number	I/O Function
3	1	TXD (transmit data)
2	2	RXD (receive data)
7	3	RTS (request to send)
8	4	CTS (clear to send)
-	5	no connection
5	6	System ground
1	-	no connection
4 (jumpered to 6)	-	DTR (data terminal ready)
6 (jumpered to 4)	-	DST (data set ready)
9	-	no connection

Note: Pins 4 and 6 of the DB-9 connector must be jumpered to each other.

USB

The USB versions of the XPM 80™ printer employ a standard USB interface cable (5 pin Mini-B connector on the printer end) to communicate from the host to the printer. Be sure that the Mini-B connector is fully engaged with the mating connector on the printer. The other end of the cable plugs into the USB port on the host. The cable length must be limited to under 3 meters.

Once the printer is connected with the host and the driver is installed, be sure to set the Port in the driver to the appropriate USB port to match the physical host-side interface cable port.

USB Pinout

Pin Number	Signal name	I/O Function
1	NC	no connection
2	D- I/O	Data -
3	D+ I/O	Data +
4	NC	no connection
5	SGND	I/O Signal Ground

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6.3.3. Paper Pre-End

The location of the Paper Pre-End connector is shown in Figure 4, while Figure 6 shows the location of the individual pins within the connector. Figure 6A shows the input circuit for these sensor connectors. The Side A PPE connector is the primary PPE connector and is located under the print egress point. A second PPE connector may also be located on Side B in some units, for convenience in making connections in some installations. The characters in parenthesis show the input as it is labeled in the XPM 80™ Diagnostic Tool.

Figure 6

PPE Connector Side A
Pin 7 – PPE Sensor Signal Path 1 (A1)
Pin 5 – PPE Sensor Power Path 1 (A1)
Pin 6 – PWE Sensor Signal Path 1 (B1)
Pin 8 – Common (Ground)

Pin 2 – PPE Sensor Signal Path 2 (A2)
Pin 4 – PPE Sensor Power Path 2 (A2)
Pin 3 – PWE Sensor Signal Path 2 (B2)
Pin 1 – Common (Ground)

PPE Connector Side B
Pin 7 – PPE Sensor Signal Path 2 (A2)
Pin 5 – PPE Sensor Power Path 2 (A2)
Pin 6 – PWE Sensor Signal Path 2 (B2)
Pin 8 – Common (Ground)
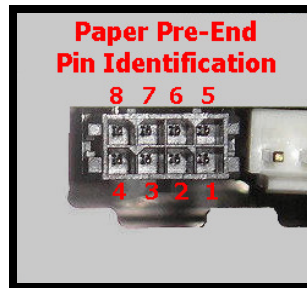
Pin 2 – PPE Sensor Signal Path 1 (A1)
Pin 4 – PPE Sensor Power Path 1 (A1)
Pin 3 – PWE Sensor Signal Path 1 (B1)
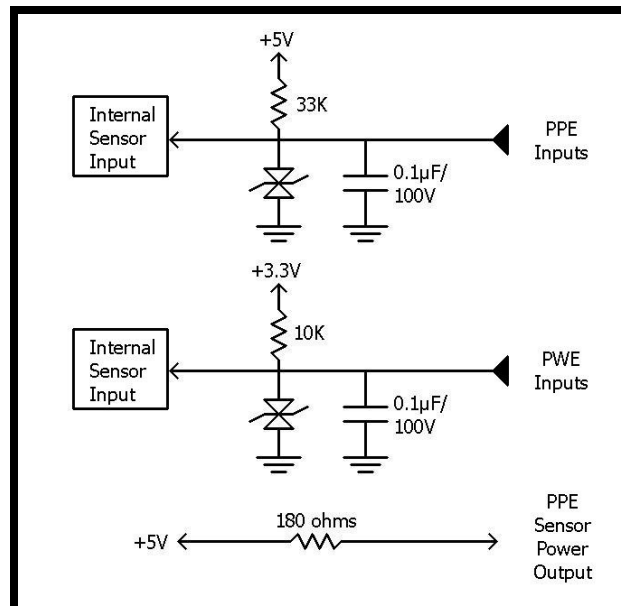Pin 1 – Common (Ground)

Figure 6A

Please note that the path signals are reversed between the connectors on Side A and Side B. This is intentional, and is intended for those cases where a customer wishes to connect the inputs from one paper path via one of the connectors, and the other paper path via the other connector. With this wiring, the same customer wiring harness may be used with the same pinout. Please note that, when so equipped, both connectors may be used simultaneously, but only one connection for each input or output may be used at once. For example, if a connection is made to the PPE Sensor Signal Path 1 (A1) [pin 7] on Side A, a connection may not be made to PPE Sensor Signal Path 1 (A1) [pin 2] on Side B.

Also, please note that the XPM 80™ does nothing more with the PPE and PWE signals than report their status through the interface. For this reason, these inputs are not limited to being used for PPE or PWE. Any one of them may be used to detect the status of a door, for example, or any other status that can be sensed via a microswitch or (in the case of the PPE inputs) an appropriate optical sensor.

6.4. Paper Supply

6.4.1. Paper Roll Holder

Based on our extensive experience in designing printers, we would urge you to consider the following topics and implement your paper roll holder design with care.

Large Diameter Rolls: When using paper rolls over 100 mm in diameter, a "dancer bar" should be considered. This usually takes the form of a spring-loaded arm under which the paper is placed before feeding it into the printer. As the printer starts to print, slack is taken up from the paper roll. This starts to lift the arm against the spring, which puts force on the paper roll and starts it moving slowly. As more printing takes place the roll gradually accelerates until it's up to printing speed. Without the dancer bar, slack paper would be taken up until it was suddenly no longer slack. Now the printer must accelerate a large, heavy paper roll from zero speed to full print speed in essentially no time. This can cause the paper advance motor to stall or the paper to slip against the platen, causing shortened characters until the paper roll is up to speed.

Spindle Friction: Another important consideration is spindle friction. As a paper roll rotates, it slides against the spindle that holds it, assuming a fixed spindle. This friction will tend to impede the paper roll's free motion, and is dependent upon the weight of the roll, the smoothness and material of the spindle, and the smoothness and material of the paper core. When possible, especially with paper rolls over 100 mm in diameter, design the spindle so that it can rotate, greatly decreasing friction and drag.

Catch Points: More paper jams and transport problems are caused by catch points than any other issue. Make sure that the paper path is free of anything that can interfere with free paper flow, especially any sharp edges or "pinch points" into which the paper may stray and become caught.

Alignment: Any paper roll holder design must hold the paper square to the printer in all planes. If the paper is angled in any way, it will enter the printer at an angle and will be more likely to cause paper jams.

Rigidity: It is important that the paper roll holder support the paper firmly and not move. This is especially true in high-speed printing applications and in large diameter paper roll applications. Many paper roll holders are made from metal too thin to support the heavy paper rolls they are expected to handle. This results in twisting and warpage while printing, which binds the paper and causes paper jams. Vibration during printing may also cause undesired movement of the paper roll.

Shipment: Do not ship your product with a paper roll mounted in the paper roll holder. The heavy weight of the paper roll can easily bend or otherwise damage the paper roll holder, as witnessed numerous times.

6.5. Power Supply Specifications

Selection of a power supply for thermal printers depends upon the printer's application, what percentage of the printout is black, frequency with which printouts are generated, and more. In particular, thermal printers draw very high currents for very short time periods (usually under one millisecond). The most important issue is not peak current, but the length of time that the power supply is able to deliver instantaneous current over its rated maximum, and for how long the print job prints high black percentages, thereby drawing high current. It is important that the power supply's over-current system does not shut down the power supply when these brief, high current surges occur.

With that said, we recommend the following power supply specifications for most applications. Please see the "Technical Specifications" section near the end of this document for full details.

DC Output Voltage: 24 volts ± 5%
DC Output Current (nominal): 4 amperes
Hold Up Time: 20 ms minimum
Current Limitations: 16 amperes minimum current limit

7. Operation

7.1. Loading Paper

The XPM 80™ is equipped with a Dual-Feed unit (DFU) which allows two different paper sources to be used. Before loading the printer, make sure that the printhead is in the "closed"; see figure 3 for details.

Insert the paper, thermosensitive side up, into one of the paper inlet slots in the rear of the DFU. It is generally easier to load the lower paper path first. When paper is inserted into one of the DFU paper inlets, the DFU automatically advances this paper and loads it into the print mechanism. You will hear the paper feed motor start to run as soon as the DFU paper detection sensor is reached. Continue to feed the paper until the rollers grasps it and pulls it forward into the printer.

Now load the second paper path in the same way. While the functionality of the paper loading can vary widely depending upon the settings of the XPM 80™ Configuration Tool, the last paper loaded is generally automatically loaded into the printer and used for printing. If you prefer to use the first paper path loaded, simply press and release the Dual-Feed control button next to the desired paper path, and the printer will automatically paper paths. (Please note that these buttons can be disabled by the Configuration Tool for security purposes. If the buttons seem to be ignored, check for this in the printer configuration.)

The XPM 80™ thermal printer family is designed to use paper with the thermosensitive side on the **outside** of the paper roll. This is important as the printer is optimized to deal with paper curl angling the paper end downward.

Please note that the XPM 80™ thermal printer family will, unless specifically configured not to do so, print an Information Report immediately when paper is loaded. This short report is extremely helpful during setup and configuration of the XPM 80™ printer. This report contains detailed information concerning the printer itself and its features, the firmware installed, the status of information in the flash memory, status of the A/D converter outputs, and the many settings that configure the printer itself. For example, this report will show all the current serial communication settings.

Please note that many of the software tools supplied with the XPM 80™ driver also allow this report to be printed by simply clicking on the "Print Info" button.

7.2. Dual-Feed Unit

The XPM 80™ is equipped with a Dual-Feed unit (DFU) to allow handling of two paper rolls. This provides two distinct benefits:

- The printer can effectively have twice the paper supply, as the DFU can be programmed to automatically switch to the second paper source if the first is exhausted.
- The printer can have two different paper supplies that have different meanings after printing. Examples might be different colored first and second class tickets, or different tickets issued for two different carriers.

DFU control pushbuttons located next to each DFU paper inlet are used to manually control the paper loading and selection process, as follows. The descriptions assume that both paper paths start with paper in them.

- **Press and release control for selected path:** Paper is placed in DFU park position. (Neither paper path is selected; printer reports out of paper.)

- **Press and release control for unselected path:** Paper for that path is loaded into printer. Printer reports "ready to print".

- **Press and hold control for selected or unselected path:** Paper for that path will eject from back of DFU. Paper will have to be fully removed to clear paper sensor and then reinserted before it can print. Printer will report out of paper if that path was the selected paper path.

Please note that these DFU control pushbuttons can be disabled via the XPM 80™ Configuration Tool for security purposes.

The two paper paths can be configured identically, or can have independent configurations. At this writing, there are 52 different settings that can be made independently for each paper path.

7.3. Printer Access Control

Figure 3 shows a top view of the print mechanism, and identifies the Printer Access Control. By pulling the recess in the direction shown, access can be gained to the paper path, printhead, platen and cutter as shown in Figure 2. To close the print mechanism, press down on the black area below the label until the upper print unit snaps closed.

7.4. Print Speed

Print speed is affected by many factors. The maximum print speed is dependent upon the operating voltage of the XPM 80™ version that you purchased. Other significant factors affecting print speed are listed below.

- Type of interface (USB fastest)
- ASCII printing vs. Graphics printing (ASCII fastest)
- Data transmission rate (serial) (faster is better)
- Default print density settings (smaller impact, but lower density is faster)
- Dot history factor (smaller impact, but "off" is faster)
- Dot history levels (smaller impact, but "off" is faster)
- Burn time correction setting (smaller impact, but the most negative numbers are faster)
- Multi-strobe factor ("off" is faster)
- Available current (higher is faster)
- Default print speed setting in configuration (higher is faster)

7.5. Cutter Operation

The XPM 80™ uses a "pizza-cutter" style paper cutter. A cutting disk moves from one side to the other to sever the paper from the roll against a stationary, fixed blade. A separate motor is used to control a helical cam that moves the "sled" holding the cutting disk. See Figure 9.

The cutter components can be accessed by opening the print mechanism. See "Printer Access Control" above for details and instructions.

The XPM 80™ configuration tool allows the specification of the weight of the paper being printed. This information is used by the printer to determine how fast the cutter should move while cutting the paper. With thinner paper, cutting can be faster. Thicker paper requires greater cutting torque from the cutter motor, which is achieved by cutting more slowly. This is automatic and transparent to the application.

In the event of a paper jam, the XPM 80™ can be configured to make several repeat attempts to cut the paper. The number of attempts can be specified by using the XPM 80™ Configuration Tool. If these attempts are unsuccessful, the printer will report a paper jam through the status system.

Note: Please be sure to remove power from the printer before opening the print mechanism and accessing the cutter blades! Always keep your fingers clear of the sharp blades themselves!
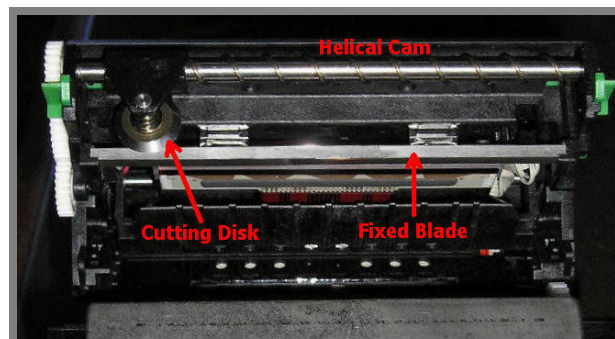

Figure 9

7.6. Print Density

The darkness of the printout can be adjusted to match the paper and your application by using the appropriate printer command (see XPM 80™ Command Set Manual P/N D 690 005) or by use of the "Print Density" settings in the Windows XP driver. Increasing print

density increases the "burn time", (the length of time that the thermal printhead elements are heated).

☞ **Note:** Excessively long burn times may adversely affect printer life!

7.7. Invalidation

The XPM 80™ printer includes the ability to invalidate printouts (render them unreadable by overprinting them with a random pattern) under certain conditions. These conditions include after loading paper; at the end of paper; when data has been lost; and on initialization. In all cases, the purpose of the feature is to prevent printouts that might be partially valid from being misused. For example, if a ticket had been in the process of printing and the power failed, the printer would stop printing. Upon restoration of power, it would be preferable to invalidate the partially printed ticket and, if appropriate, have the host send a new one to be printed. By enabling "Invalidate paper on initialization", this can be accomplished.

7.8. XPM 80™ Digital Tools

The XPM 80™ family of thermal printers includes with the Windows XP driver a series of very useful tools. These can be run directly from the Tools folder of the driver package once the driver has been installed. A brief summary of these tools is shown below.

☞ **Note:** It is important to note that the behavior of the XPM 80™ is heavily dependent upon the settings determined by the Configuration Tool.

XPM 80™ Command Tool: Very simple tool for sending Native Commands to the printer.

XPM 80™ Configuration Tool: A very important tool that allows you to change virtually any variable setting or performance characteristic of your XPM 80™ printer.

XPM 80™ Diagnostic Tool: A powerful tool for identifying possible issues with your printer, its peripherals and firmware by examining the details of its operation.

XPM 80™ Font Tool: Used for uploading and assigning different fonts within the XPM 80™ printer.

XPM 80™ Image Tool: This very helpful tool creates XPM 80™ format graphic files from standard format graphic files so they can be uploaded as stored images.

XPM 80™ Print Terminal: Possibly the most useful tool of the bunch, the Print Terminal has six sets of 24 buttons each, many of them preprogrammed to transmit commands to your XPM 80™ printer. All buttons are programmable to make them transmit whatever is needed. This tool is very popular with software developers who are integrating the XPM 80™ into their products as a tool that they use to verify command sequences and responses.

XPM 80™ Uninstaller Tool: Use this tool to uninstall single or all versions of the XPM 80™ driver.

XPM 80™ Upload Tool: Used to upload new firmware, specific data files, etc. to the flash area of your XPM 80™ printer.

XPM 80™ Wide Font Tool: Used for uploading Wide Font formats (such as Chinese or Korean) from standard graphic files.

8.   Low Current Operation

There are numerous factors that affect thermal printer current. It is possible to manipulate these factors consciously to reduce current draw for situations where this is important, such as operating from batteries. If battery operation only occurs when power has failed, the host software can be programmed to print at a faster, higher current rate during normal operation and then switch the

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XPM 80™ to a lower current mode when the system switches to battery operation. The following are some considerations to aid in reducing current draw.

8.1. Print Speed

With thermal printers, average current is proportional to print speed. Since the burn time for each dot row is fixed, when printing slower there is more pause between burns and therefore a lower average current. (The peak current is determined by the number of dots burned at once, and so is unaffected by print speed.) The XPM 80™ target print speed (called the "target speed" because other settings may cause the actual print speed to be lower than this) can be set via the interface; please refer to the XPM 80™ Emulation Command Set Reference for the specific command sequence. The slower this print speed is, the lower the average current draw will be. Note that when using the XPM 80™ Windows XP driver, the driver will override settings sent to the printer directly via the interface.

8.2. Graphics/Bar Codes

Printing graphics rather than text consumes more current than printing only text. Typical text-only printing is considered to be 12.5% coverage on average, while graphic printing varies from 25% to 50% average, consuming 2X to 4X the average current. Printing bar codes is in the same category, and draws about 4X the current of text. Both should be avoided or minimized to reduce current draw. In terms of current draw, it does not matter whether printing is done using the printer's internal character set or the via the driver.

8.3. Reverse Printing

Reverse printing should be avoided, since everything that's normally black becomes white, and vice-versa, drawing (in average text) about 8 times the current.

8.4. Dot History Factor

Dot history monitors previously burned dots and reheats them for a shorter time to prevent blooming and excessively black areas, thereby decreasing total current consumption. Using dot history and minimizing the main burn time will reduce average current draw. Please refer to the XPM 80™ Emulation Command Set Reference for the specific command sequence.

8.5. Burn Time Correction

The XPM 80™ family of printers include a feature that will adjust burn time automatically depending upon ambient temperature. Burn Time Correction allows the adjustment of these burn times to "tune" the printer to maximum performance for any given paper, thereby improving print quality but having little effect on current consumption. If current draw is truly critical, reducing these values will reduce current slightly at the cost of lower contrast in the printout. Please refer to the XPM 80™ Emulation Command Set Reference for the specific command sequence.

8.6. Multi-Strobe Factor

This feature is the only XPM 80™ software feature that will reduce **peak** current. When this features is turned on, only one side of the printhead is fired at a time, reducing the peak current by a factor of two, but having virtually no effect on average current. This is very useful if your power supply has a restrictive maximum current, but slows printing. Please refer to the XPM 80™ Emulation Command Set Reference for the specific command sequence.

8.7. Print Density Adjustment

Increasing print density will improve print quality, but at the same time will increase average current. Therefore Print Density is always a trade-off between these two characteristics. Use the lowest print density that is visually acceptable to minimize current draw. Please refer to the XPM 80™ Emulation Command Set Reference for the specific command sequence.

9. Troubleshooting

Symptom	Possible Cause	Corrective Action
No LEDs light on printer	1. Power not connected 2. PCB mounted fuse blown	1. Check line cord and outlet 2. Return printer for fuse replacement; not field replaceable
LEDs flashing	See Section "LED Indicators"	See Section "LED Indicators"
Dual-Feed unit will not run when paper inserted	1. If paper has been ejected by DFU control button, it must be completely removed from DFU and reinserted to feed. 2. Narrow paper not blocking sensor in center of path	1. Remove and reinsert paper. 2. Center paper
Printer prints blank paper	1. Paper inserted upside-down 2. Wrong side of roll coated 3. Printout positioned outside printable area by "set" command	1. Invert paper roll 2. Invert roll as test, have paper made properly 3. Change "set" command settings to relocate printout
Print quality poor	1. Print density set too low 2. Printhead not fully lowered 3. Incorrect paper type for XPM 80™ printhead	1. Adjust print density, other burn time adjustments. 2. Lower printhead. 3. Procure and use correct paper.
Baud rate, other configuration setting changes not implemented after use of Configuration Tool	1. Printer was not reset after changes made with Configuration Tool.	1. Reset printer. Consider enabling "Automatically reset printer" option on "Tool Settings" tab of XPM 80™ Configuration Tool.

10. Maintenance

The XPM 80™ printers require very little maintenance.

☞ **Note:** Discharge your body's static electric charge by touching a grounded surface before performing any maintenance procedure. Do not touch the connector pins of the printhead cable with your bare hands.

☞ **Note:** Do not touch the surface of the thermal printhead. Mechanical stress or shock (including foreign contamination) to the surface of the printhead substrate should be avoided to prevent printhead damage.

Cleaning the XPM 80™ Printer
Clean the XPM 80™ whenever it becomes dusty, as paper dust will reduce the friction of the platen and cause the print quality to deteriorate.

- Open the print mechanism by using the Printer Access Control. **Remove any paper**, if necessary.
- Clean the platen with a special platen cleaning agent and a lint-free cloth. DO NOT use alcohol to clean the platen because alcohol hardens the platen material.
- Gently wipe the surface of the thermal printhead using a cotton pad soaked in METHANOL to remove dust on the heating elements. DO NOT use sandpaper or other abrasives.
- Dry the XPM 80™ mechanism completely and reload the paper.

☞ **Note:** Condensation should be avoided. If condensation occurs, do not power the printer until all condensation has dissipated.

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11. Repair

All Hengstler printers are repaired at our facility in Aldingen, Germany. For details, and to arrange for the return of a printer for repair, please contact us at:

HENGSTLER GmbH
Uhlandstrasse 49
78554 Aldingen / Germany
Tel. +49 (0) 7424-89 0
Fax +49 (0) 7424-89 500
eMail: info@hengstler.com
www.hengstler.com

12. Buying Paper

12.1. Sourcing Paper

In order to maintain your warranty, use only paper that conforms with XPM 80™ Paper Specification D 689 112. Use of paper that does not conform with this specification may adversely affect the performance of your XPM 80™ printer and/or damage your printer. Please note that the XPM 80™ can use either roll or fanfold paper. When using fanfold paper, care must be taken to configure the printer, black mark, and positioning so that the cut always occurs **after** the fanfold bend, not on it or before it. Failure to do so will cause cutting problems and will likely increase paper jams.

12.2. Converting Paper

Thermal paper is usually purchased through paper converters. These companies buy large, jumbo rolls of specific paper types from the few true paper manufacturers in the world and then cut it and roll it to your specifications. You may elect to have preprinting or black marks added at this time, as well. Please make sure that any paper a converter wishes to supply you for use with your XPM 80™ printer conforms with XPM 80™ Paper Specification D 689 112.

12.3. Black Mark Sensor Location

The Black Mark sensor (which also functions as a "paper present" sensor) on the XPM 80™ printers can be located in numerous positions during manufacturing. Figure 8 shows where the black marks should be located in order to be detected when a reflex sensor is used. The default (standard) sensor positions are so marked.

The XPM 80™ printer is designed to allow for numerous Paper Entrance/Black Mark sensor locations during manufacturing. (The location of this sensor cannot be changed once the printer is built.) Also, two different sensor types can be used. The most common is the reflex or reflective sensor, where the light source and detector are located on a single chip. Basically, the light strikes the white paper surface and reflects back into the sensor. If enough light reflects to activate the sensor, the printer reports that paper is present. If there is not enough light reflected, the printer assumes that this area is black, meaning the printer is on a black mark or the printer is out of paper. Black marks must be located on the back (non-coated) side of the thermal paper. There are seven (7) different possible positions for this sensor. The positions of these sensors are detailed in Figure 8. (Please note that sensor position 1 is not usable.) The default (standard) positions are so marked. Please note that sensor locations other than the default location are intended for OEM applications.

The XPM 80™ can also use a through-beam sensor. This type of sensor has a separate light source and detector. The light is transmitted across the paper path into a prism, which redirects it back across the paper path into the detector. When the light is blocked and cannot reach the detector, the printer reports that paper is present. When the light does reach the sensor, the printer concludes that there is no paper present.

The through-beam sensor can also be used in a manner similar to a Black Mark sensor. Instead of a Black Mark, a hole is used in the paper. The through-beam sensor is located in one of seven (7) different possible locations; the centerline location of the paper path is the default. The possible positions of these sensors are detailed in the Figure 9.
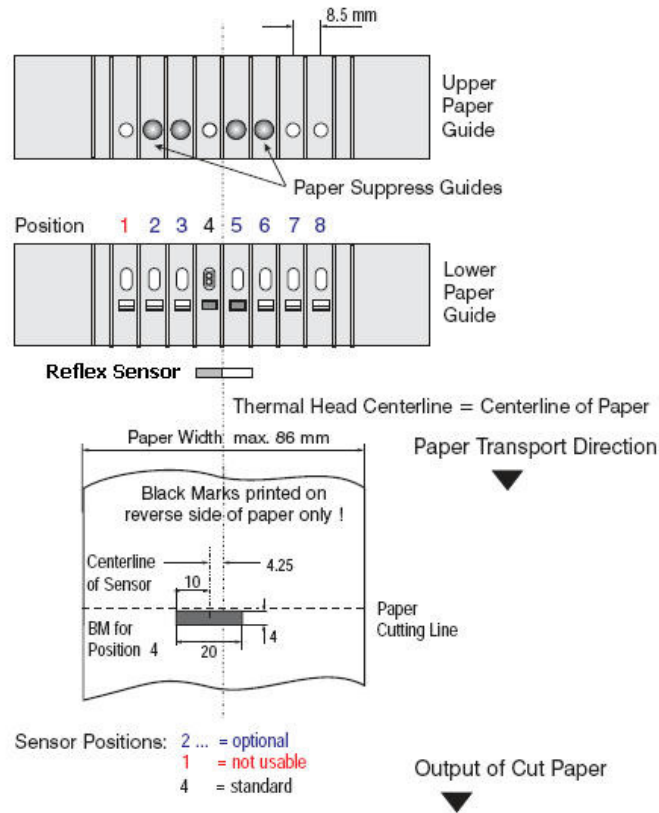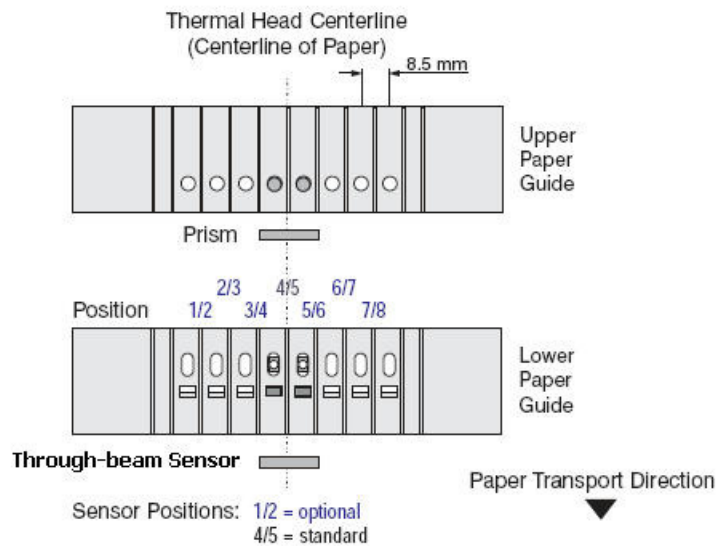

Figure 8

Figure 9

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13. Technical Specifications

Technology:	Direct Thermal
Print Speed:	Up to 250 mm/sec
Resolution:	203 dpi

Printhead Life

Abrasion (based on 12.5% print density)	100 km of paper
Electrical:	100 million dot pulses
Controller MTBF:	>100,000 hours (Life may be adversely affected by excessively long burn times during printing)

Graphic Driver:	Windows® XP, Vista, Linux (CUPS)
Bar Codes:	
Internally Generated:	UPC-A, UPC-E, EAN-13, EAN-8, Code 39, Interleaved 2 of 5, Code 128, Codabar, PDF 417
Externally Generated:	Any, generated by Windows® standard GDI file by host
Bar Code Scanner:	Optional; for preprinted barcodes

Paper Width:	55-86 mm (narrower widths may be possible in certain OEM applications. Contact Hengstler for details.)
Printable Width:	80 mm
Paper Weight:	60 to 250 g/m²
Paper Capacity:	6 inch (150 mm) roll diameter 12 inch (300 mm) (reduced performance)
Interface Type:	USB 1.1 and RS-232 (115,200 baud maximum) (Cable length <3 meters) (RS-232 not available with barcode scanner option)
Operating Voltage:	24 VDC ±5%

Current Draw:

In standby, approx.	100 mA typ., (depending upon options and settings)
Typical, approx.	With Hengstler paper, at 21°C ambient temperature, with a print speed of 100 mm/sec, voltage of 24.0 VDC, and print density (coverage) of 12.5%: <**1.9 A avg.**

Cutter:	"Pizza-cutter" type
Dual-Feed Unit:	Two paths with separate paper control buttons
Dimensions (WxHxD):	142 x 132 x 224 mm (approx.)

Temperature Range

Operating:	+5ºC to +70ºC (Wider temperature range may be possible; consult Hengstler for details)
Storage:	-30ºC to +70ºC

Humidity Range

Operating:	20%-80% RH, non-condensing
Storage:	10%-90% RH, non-condensing

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13.1. Electromagnetic Compatibility

13.1.1. FCC Part 15 Class B Device

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

13.1.2. EN55022 – Emissions

The XPM 80™ family of thermal printers are class "B" appliances.

☞ When operating the printer from a DC building power supply, or when the DC power cable exceeds 3 meters in length, appropriate EMI filters must be used.

13.1.3. EN55024 – Electromagnetic Susceptibility

☞ Electrostatic discharges and burst effects may cause short printing interruptions, but the automatic recovery function of the printer will restore it to its original state.

⚠ Additional action regarding lightning and overvoltage protection will be needed if cables and wires are installed outside of a building.

However, this standard can be met only if original units, components, and cables are used and the installation instructions are respected and followed completely.

☞ External interference caused by ESD or EMI can temporarily cause corrupted printing or data loss.

13.2. Printer Drawings

Please refer to the appropriate drawing listed in section 1.1 of this document for dimensions and mounting information.