HENGSTLER

Operating Manual

eXtendo® XF

Thermal Printer Family

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1 Introduction

Thank you for selecting the Hengstler eXtendo® XF 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 system and start-up of the eXtendo® XF thermal printer. 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 eXtendo® XF thermal printer family does not require any servicing and is intended for printing and cutting documents and receipts from continuous thermal paper rolls or from fan-folded paper stock. Two paper cutter variants are available to handle stocks up to 160 g/m².
Powerful motors allow the use of large paper rolls to maximize time between paper replenishment. If documents are to be printed on preprinted forms or with a predetermined length, 'Black Mark' control is available (black marks or hole marks).

The eXtendo® XF printer family has been designed for use in a wide variety of applications, including ticketing, parking, transit, reverse-vending, car wash, fuel dispensing, vending and other kiosk applications.

The printer is available with USB2.0 and RS-232 data interfaces. Driver software including a rich set of tool is available that supports Windows and Linux operating systems. In addition, the printer can also be operated directly in ASCII mode through ESC sequences a detailed description of which can be found in the eXtendo® Emulation Command Set Reference.

We're glad you chose the eXtendo® XF thermal printer family. Once you've used it, we're sure you will be, too!

1.1 Additional Documentation [1]

Document No.	Description
D-684-112	eXtendo® Emulation Command Set Reference
D-684-128	eXtendo Paper Specification
D-684-398	X-56 XF Dimensional Drawing Printer
D-684-396	X-56 XF Dimensional Drawing Paper Roll Holder
D-684-390	Dimensional Paper Low Sensor (PPE)
D-684-401	Dimensional Mounting Brackets
D-684-402	Dimensional Paper Guides

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[1] All listed documents can be found in the download area on our webpage under Thermal Printers. If any of these are missing, please contact our technical support (→ section *9 Support and Repair*).

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 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.

→ Cross Reference

2.2 General Information

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

☞ Connect the printer closely to the power supply to minimize ground level rise during high-current-draw printing. Connect the host signal GND closely to the printer GND (star topology).
Note: Different GND levels between host and printer can lead to high compensating currents through the data cable which can impact the data transmission or even damage printer or host electronics. If you cannot provide sufficient grounding, consider using appropriate data port isolators.

☞ 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.

☞ Unapproved types of thermal paper may drastically reduce the life of the print head or cutter and may cause the guarantee to expire. For pre-printed thermal paper make sure that only appropriate inks are used. Details can be found in the Hengstler Paper Specifications as listed in → Chapter 1.1.

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

☞ 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 to 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.

☞ Make sure the printhead properly locks and both ends of the locking shaft are snapped into their final positions (→ chapter 3.2 detail 3a).

3 Overview

3.1 Overview of Thermal Printing Technology
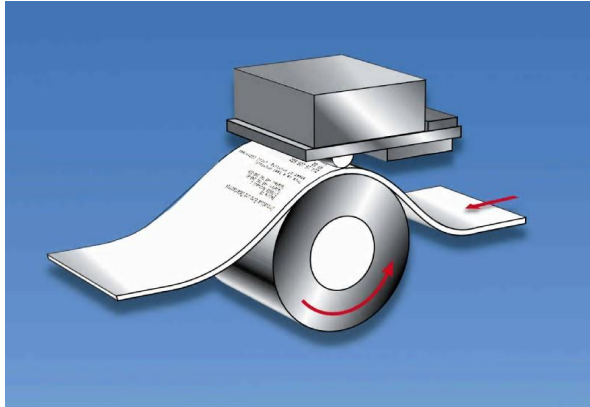
A brief overview of thermal printer technology might be helpful to understand how the eXtendo® XF thermal printer family works. In most direct thermal printers, paper is fed over a soft, rotating platen (see Pos. 4 in Figure 1 in chapter 3) and under the thermal printhead (Pos. 3). The platen acts as a roller to advance the paper at the same time it 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 immediately note 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.

3.2 Functional View

Paper Feed Direction
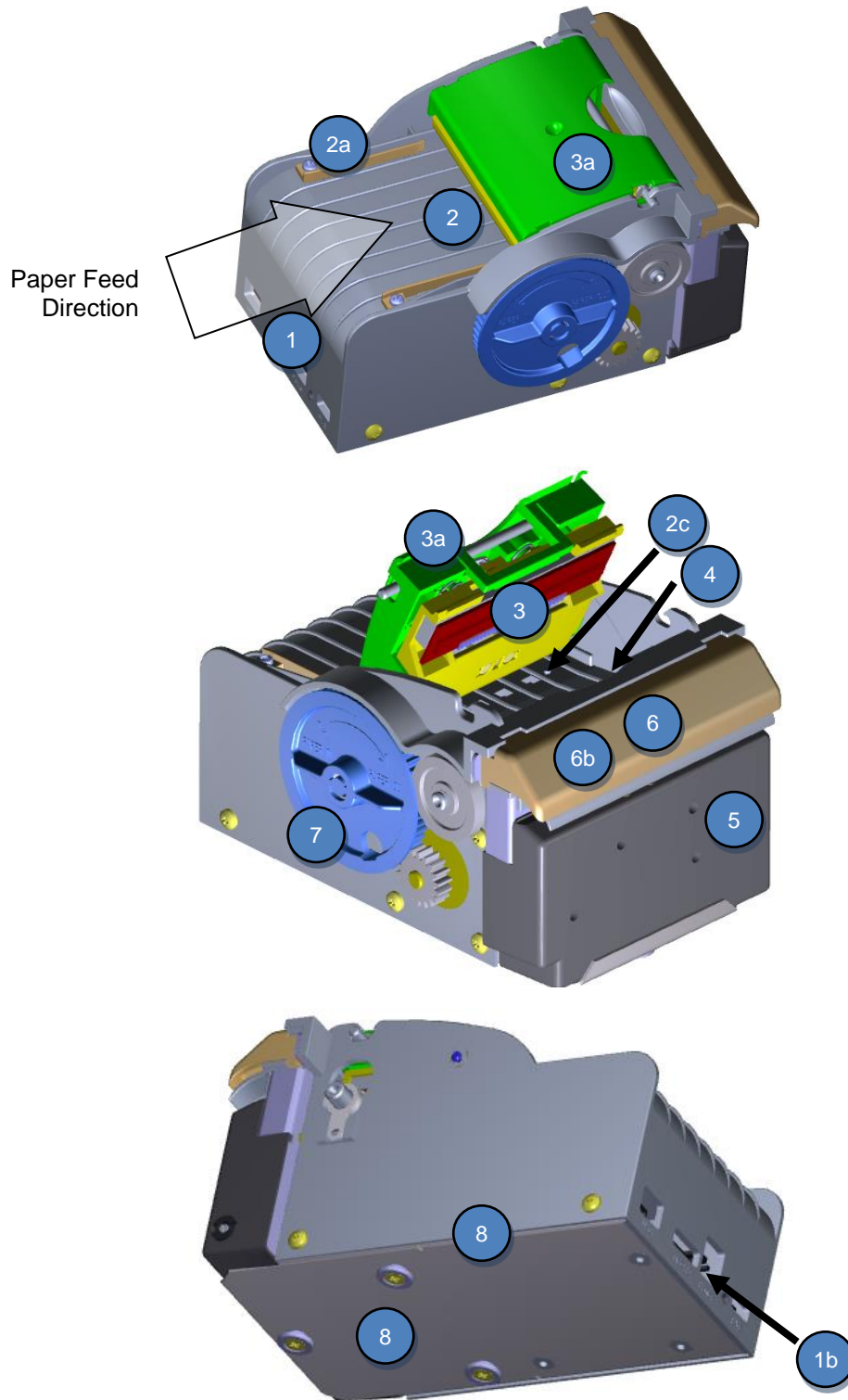
Figure 1 – Key Components

Pos.	Element
1	Connectors and Indicators
1b	Controller Board (not visible here, mounted inside)
2	Paper Entry Path
2a	Paper Guides (optional)
2c	Paper Sensor
3	Thermal Print Head
3a	Print Head Holder with Locking Shaft
4	Platen (not visible here)
5	Cutter Module
6	Paper Chute
	Chute Sensor (not visible here)
7	Motor Gearing and Paper Advance Wheel
8	Bottom Plate with Mounting Options

3.3 Connectors and Indicators

The following figure below shows the locations of connectors and indicators (1) on the eXtendo® XF series including a detailed view of a connected DC power cable.

The printer comes with a USB2.0 and an RS232 data interface which can be connected one at a time or both concurrently.
DC power connects via a 2-pin connector, details of which can be found in chapter 4.5.1
For information about the paper low input circuitry and wiring see chapter 3.5.5.
For details about the LED status indicator please refer to chapter 3.5.2.
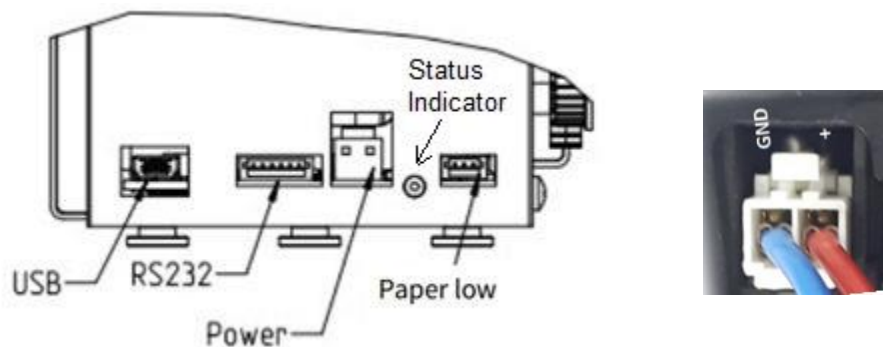
Figure 2

3.4 Components and Operation

The thermal printhead (3) is positioned above the silicon platen (4). The platen acts as a roller to advance the paper at the same time 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, and paper cutter are all connected to the controller, which controls all these components to function at the proper time and which also communicates to the host. The cutter (5) separates the paper from the paper roll after printing the ticket. Several sensors monitor progress as the printed document is created.

The paper entrance sensor (2b) detects if paper is approached in the paper load area (2). As soon as the paper reaches the paper sensor, the motor (7 starts driving the platen (4) under the printhead and printing can begin.

While printing, the paper continues to advance and enters the paper cutter, where it passes between the cutter blades and out the print chute and passes the chute sensor. Once printing is completed, the paper is advanced and cut by the cutter. The paper then retracts to a park position ready for the next print job.

When the printer runs out of paper, the paper entrance sensor detects the fact. As a standard behavior, the printer stops printing and backs up the paper, so it protrudes from the back of the printer. This is to allow the operator to remove the partially printed document before loading a new roll of paper. There are settings available that allow the printer to continue printing until the last bit of paper without retracting. Care must be taken in such a case because it would be possible for short pieces of paper to remain in the paper path without the operator's knowledge. It is, however, easy to remove such paper pieces when you open the print head.

The paper chute is a short mouthpiece at the front of the printer. The paper chute should be present for printing applications where the ticket is presented through the panel or guided in a chute, but it should be removed for applications where the printed document is expected to fall freely into a bin or other pathway. In the latter cases, the chute may interfere with the free fall of the printed document.

The paper sensor located at the paper exit monitors whether there is paper in the chute. A more detailed description of this sensor can be found in chapter 3.5.4.

3.5 Operation of Sensors and Status Indicator

3.5.1 Paper Entrance / Black Mark Sensor

The basic function of the paper sensor in the paper entrance area (2c) has been described above. But the same sensor is also used to detect Black Marks. Black Marks are preprinted black fields placed at equal distances on the paper during the paper converting process. They are used to advance the paper to a specific and reproducible position prior to cutting a ticket. The most common reason for this is to always locate the printout relative to the marks, for example, printing inside a preprinted box or close to a logo. Black marks must be located on the back (opposite the thermal side) of the paper.

The eXtendo® XF series of printers is designed to allow for various 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 into the sensor. If enough light reflects to activate the sensor, the printer concludes 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 different possible positions for this sensor. All these positions sense the non-coated (back) side of the paper; for details see → chapter 10.2.

The eXtendo® XF can also use a through-beam sensor. Other than at the reflective type, this sensor type has a light source and a detector. When the light that goes through the paper is blocked, the printer concludes that paper is present. When the light goes "through" the paper, the printer concludes that there is no paper present or a hole mark is located at the sensor position.

The through-beam sensor can also be used in a manner similar to a Black Mark sensor. Instead of a Black Mark, a hole or slit cutout in the paper is used. The through-beam sensor is located around the centerline of the paper path. This is the only location it may use. See → chapter 10.2.

3.5.2 Status Indicator

There is a two-color status indicator in the eXtendo® XF series printers, located on the rear side (see Fig. 2). It is used to signal the current status of the eXtendo® XF printer. There are several flashing speeds used in the printer LEDs. These are:

Slow: 0.5 Hz   (LED is "on" for one second and "off" for one second)
Medium: 5 Hz   ("on" for 100 ms and "off" for 100 ms)
Flicker (F): 10 Hz   ("on" for 50 ms and "off" for 50 ms)
0:                                  (off for 1 second)
1:                                  (on for 1 second)

Green LED	Red LED	Meaning
Slow	Off	Paper is loaded. Normal operation. Printer ready.
Medium	Off	Out of paper; printer ready for paper loading.
Flicker	**On**	Data upload in progress (fonts, images, firmware). Do NOT disconnect or power the printer off in this condition!
F 0 F	**On**	Printhead raised or printer stalled or over voltage
F 010 F	**On**	Paper error
F 01010 F	**On**	Cutter error
Off	**On**	Boot failure
Flicker	**Flicker**	Initialization error
On	**On**	System "hung" during initialization

☞ Please note that much more detailed information concerning the printer's current state and sensor conditions can be obtained by requesting the printer's status (→ eXtendo® Emulation Command Set Reference D 684 112) or by using the eXtendo® Diagnostic Tool.

3.5.3 Printhead Status Sensor

An additional Head Status Sensor is used to determine whether the printhead is in the unlocked or locked position (ready to print). Normally, most of the heat generated by thermal printing is transferred to the paper being printed and so is removed from the head as the paper advances. When the printhead is in unlocked position no printing or paper loading is possible.
The output of this sensor as well as the current printhead temperature is also available through various query functions.

3.5.4 Exit Sensor

The exit sensor located in the chute continually monitors whether there is paper in the chute and can be read via the status request function. This function is often used in conjunction with the host's peripherals to signal the user when a printout has not been taken. Examples where this is important include when the information is confidential, or the printout can be redeemed for cash or items of value. This function can also be used to prevent the host from sending a new print job until the printout from the previous print job has been taken away.

Additionally, the exit sensor is monitored while first printing after a cut. After a cut, the printer "knows" where the end of the paper is. As printing takes place, the printer also "knows" when the edge of the paper should reach the sensor. If the paper does not reach the sensor when expected, the printer reports a paper jam through the status request command.

☞ **Note**: Care must be taken when mounting the eXtendo® XF printers to ensure that the sensor is not exposed to direct sunlight. The multiple wavelengths of sunlight can cause false readings from this sensor. Therefore, always shield the chute and sensor from direct sunlight by use of chutes, shrouds, covers and similar techniques.

3.5.5 Paper Low Sensor Option

An optional Paper Pre-End Sensor can be mounted by the customer. The sensor is a reflective type, meaning that it senses paper by bouncing light off the paper and detecting its reflection. The sensor is equipped with a long cable to allow flexible mounting by the customer, and the sensor itself is mounted on a small circuit board with a hole to be used for mounting it. Simply mount the sensor where it will detect paper low. It typically mounted facing the side of the paper roll, so that as the diameter of the paper roll decreases, it eventually loses the reflection of the light and changes state. Plug the PPE sensor into the sensor connector on the printer rear side. While the exact distance of the sensor from the paper varies from application to application, it is typically 2-5 mm for optimal sensing, compare Figure 5.
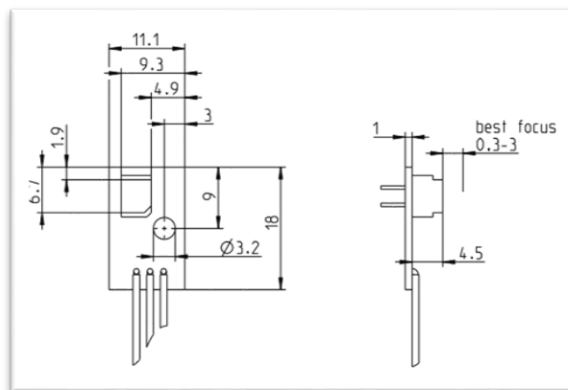

Figure 5 – Paper low sensor

If the printer with a paper roll holder is ordered, the sensor comes pre-mounted to the paper roll holder and with the sensor connector plugged into the eXtendo® XF controller board. Figure 5 shows the PPE sensor itself, while Figure 6 is the input circuit to the Paper Pre-End (Paper Low) sensor.
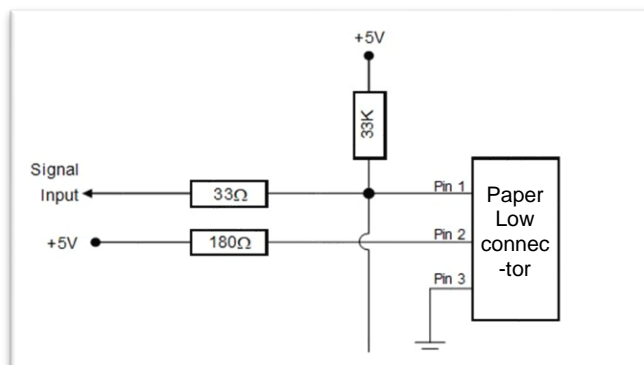

Figure 6 – Paper Low Sensor Circuit

3.6 Graphic Printing vs. Printing with Printer's Fonts

One area that causes frequent confusion regarding 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 eXtendo® XF easier for you.

All printers contain a set of commands that will cause the printer to perform different functions (For the eXtendo® XF family of thermal printers, these commands are documented in the eXtendo® Emulation Command Set Reference, p/n D 684 112). 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 several 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 characters 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 eXtendo® XF would require 1,120 bytes (56 bytes/dot line * 20 dot lines) to print one "text" line (please note that these are estimates, and that various compression routines also impact the amount of data bytes).

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 much more data must be sent over the interface.

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 may be the better choice due to its higher speed, and serial may increase the time to complete a printout to an unacceptably long period.

3.7 Features Selected at Time of Order

One of the strengths of the eXtendo® XF family of thermal printers is that it allows the designer to select the features needed, rather than settling for performance less than desired or having to pay for features that will never be used. The current set of available options is listed below.

Feature Description	Option 1	Option 2	Option 3
Voltage	24 VDC	12 VDC	
Cutter	Twincut, Full and Partial Cut, up to 120 g/m²	Twincut, Full Cut Only, up to 160 g/m²	
Paper Entry Sensor	Black Mark Sensor (Standard: Pos. 6)	Through-beam Sensor in center position	Black Mark Sensor in other position
Mounting	3 mounting hubs on bottom plate (Standard)	customizable option *): no bottom hubs 2 mounting brackets or a paper roll holder or just M3 screws can be used instead	customizable option *): pre-assembled with mounting brackets or paper roll holder or other customized mounting
Warranty	1 year warranty (Standard)	customizable option *): more than 1 year warranty	
For available accessories see the list at the end of this document			
*) customizable options on request (will require delivery agreement)			

4   Installation

4.1 Unpacking

Care should be taken when unpacking your eXtendo® XF printer to preserve the packing material for possible future use. eXtendo® XF 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 eXtendo® XF unit.

4.2 Function

☞   Please note that the eXtendo® XF 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.
This printer is not designed to be operated as a standalone desktop unit.

4.3 Mounting the Printer

In the standard version the eXtendo® XF printer is built with three quick-fit hubs for sliding and locking in key holes. The quick-fit hubs can be removed leaving 4x M3 threads for mounting. See the dimensional drawings for details.
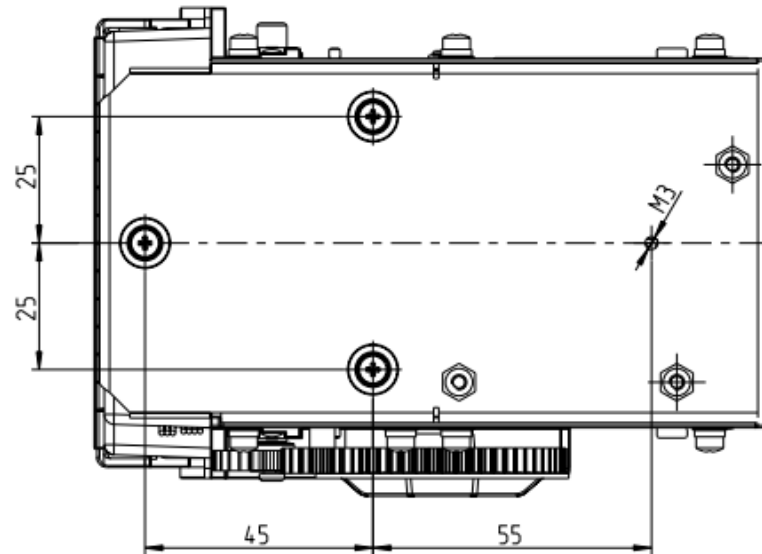
Bottom View

Alternatively, the printer can be mounted using the optional mounting brackets. These brackets are fixed to the printer with the existing screws on the sides of the printer chassis. If you order the mounting bracket as an accessory, just remove the four screws on the printer sides and fix the bracket with the same screws again. See the dimensional drawings for details.
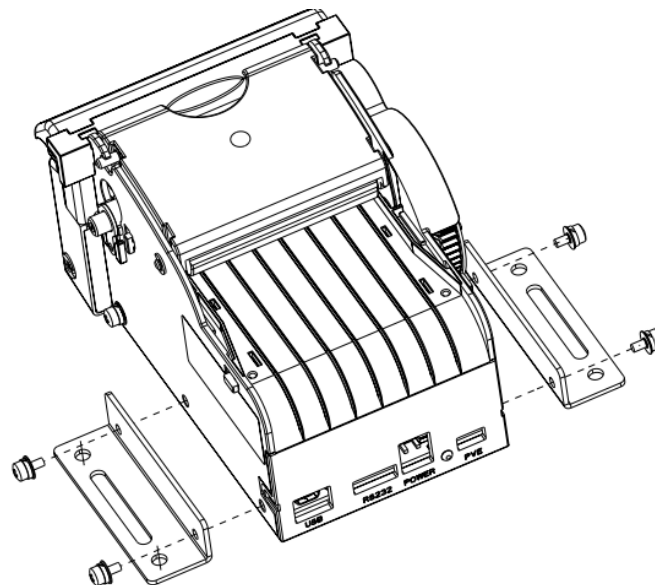
Alternatively, the printer can be mounted using the optional paper roll holder. The roll holder is fixed to the printer with the existing screws on the sides of the printer chassis. See the dimensional drawings for details.
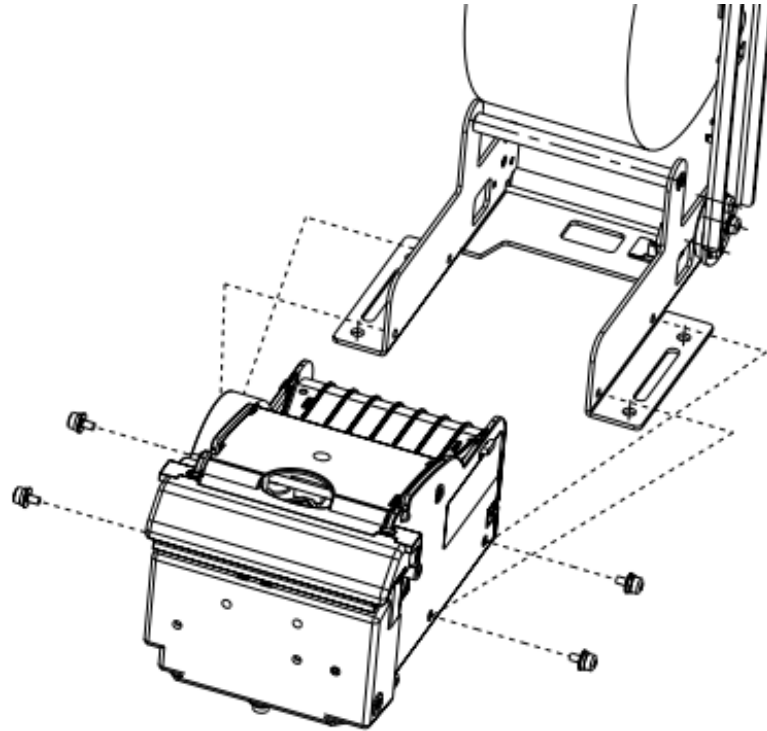
4.4 Paper Guides

Some applications like parking ticket dispensing use paper in the format of 54 mm wide credit cards. The eXtendo® XF printer is able to handle such 54 mm wide paper with optional paper guides. They are attached to the paper path of the printer with the screws that come with the paper guides. Please don't overwind the screw when mounting the paper guides. See the dimensional drawings for details.
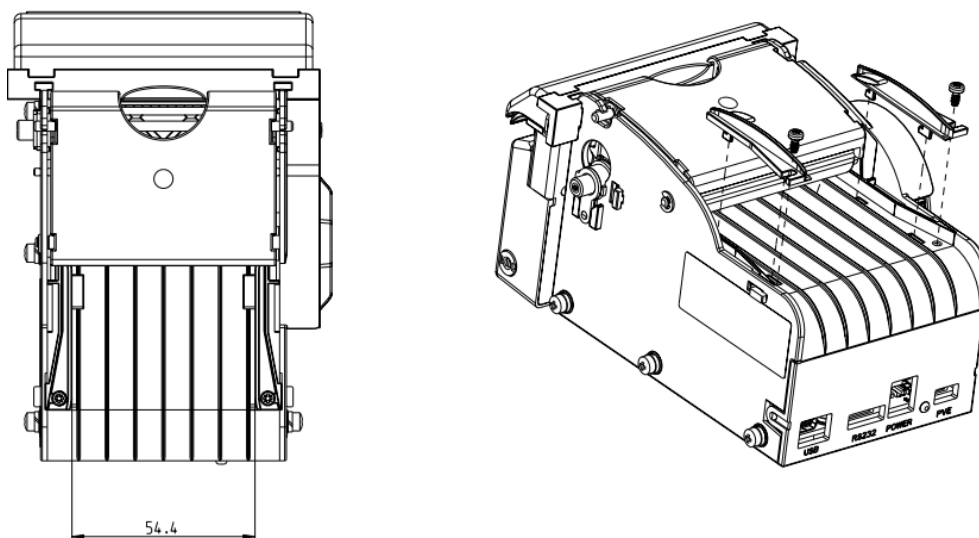
4.5 Wiring

4.5.1 Power

Power is connected to the eXtendo® XF thermal printer via a JST connector. The connector consists of a JST VHR-2N (RA 3. 96) shell and two SVH-21T-P1. 1 contacts. Wiring is as follows:

Pin   _Function_
  1   0 VDC/GND (-)   (blue wire)
  2   24 VDC   (+) (red wire)

The left contact on the connector is common; the right contact is the positive (+) voltage (→ Fig. 3).
Note: USB Signal GND and power GND are connected to each other.

4.5.2 Data Interfacing USB

T eXtendo® XF printer employ USB2.0 connection a standard digital camera USB interface cable (5 pin Mini-B connector on the printer end) to communicate with the host. 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 a USB port on the host.

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 GND *(internally connected to 0 VDC)*

☞ Please note that the shell of the USB connector only makes a capacitive connection to the signal ground.

☞ Please observe the notes regarding signal grounding in → Chapter 2.2.

4.5.3 Data Interfacing RS232

The printer is shipped with the following 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 eXtendo® XF printer's status data. It uses the hardware handshake lines to prevent the host from sending more data if the printer registers "paper out").

The eXtendo® XF printer uses a JST ZHR-6 connector shell with JST SZH-002T-P0.5 contacts 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 (→ section *12 Spare Parts and Accessories*). Connections are as follows, should you decide to make your own data cable or connectors.

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Serial Pinout

DB-9 female Pin #	ZHR-6 Pin#	I/O Function (Printer view)
8..........................1		RTS\
7..........................2		CTS\
5..........................3		GND *(internally connected to 0 VDC)*
2..........................4		TXD\
3..........................5		RXD\
--	6	n/c (leave unconnected)
1		n/c
4		jumper to pin 6
6		jumper to pin 4
9		n/c
Shell		Earth Ground

☞ Please note that the Hengstler cable is supplied with a flying pigtail on the printer end. This pigtail is intended to be fastened to the chassis. If it is not needed, it can be cut off or just left open.

☞ Please observe the notes regarding signal grounding in → Chapter 2.2.

4.6 Paper Supply

4.6.1 Hengstler Paper Roll Holders

Hengstler offers a roll holder kit for use with the eXtendo® XF printers. The paper roll holder is intended for paper rolls up to 200 mm diameter and comes with a paper pre-end sensor. The roll holder arm can be adjusted at 9 different angles for utmost flexibility.
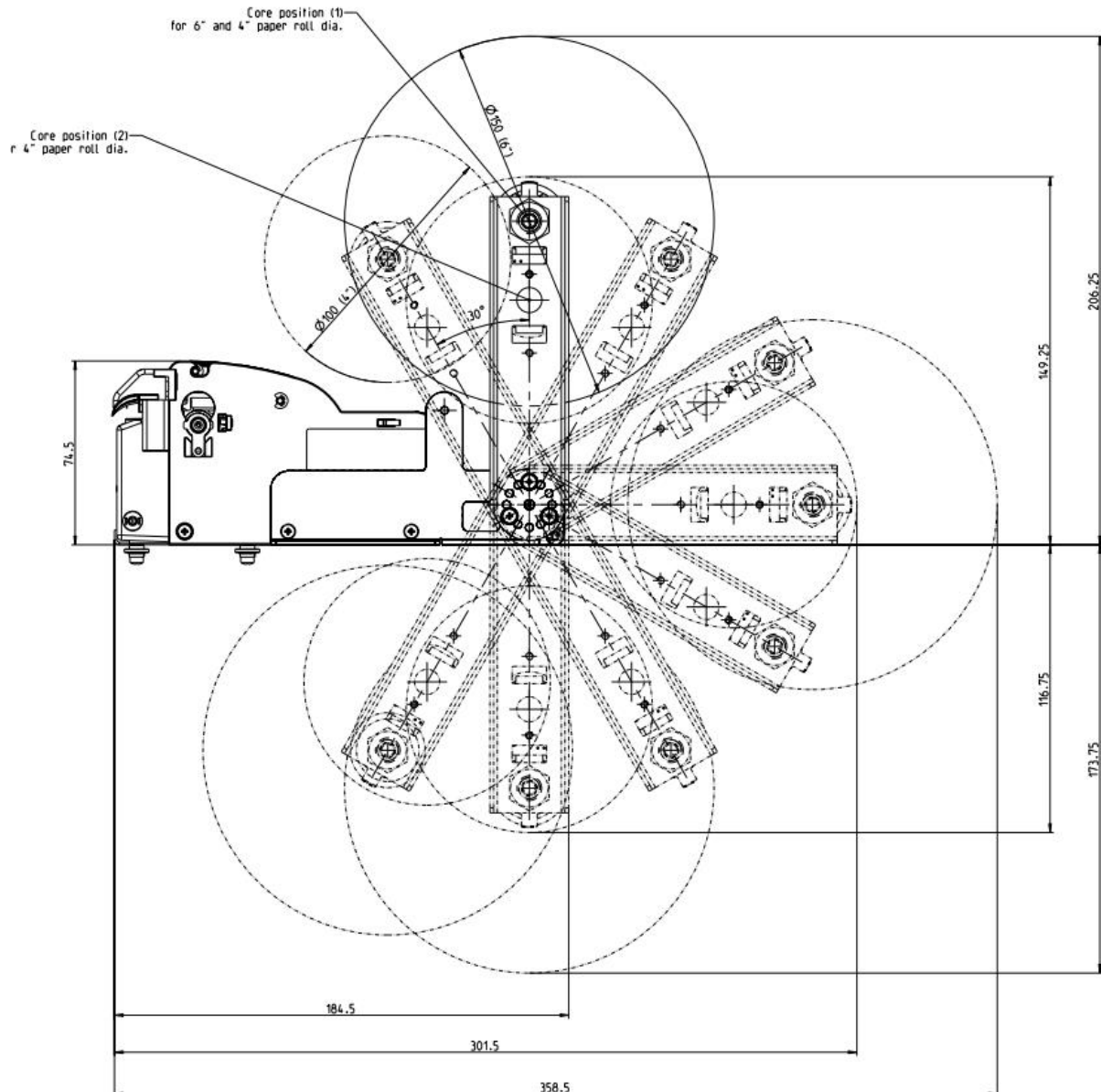
To suit the accessibility of your installation, the roll holder arm can be mounted on the left or on the right side. Please consider that the paper roll must be moved over the spindle sideway.

LEFT SIDE ARM   RIGHT SIDE ARM
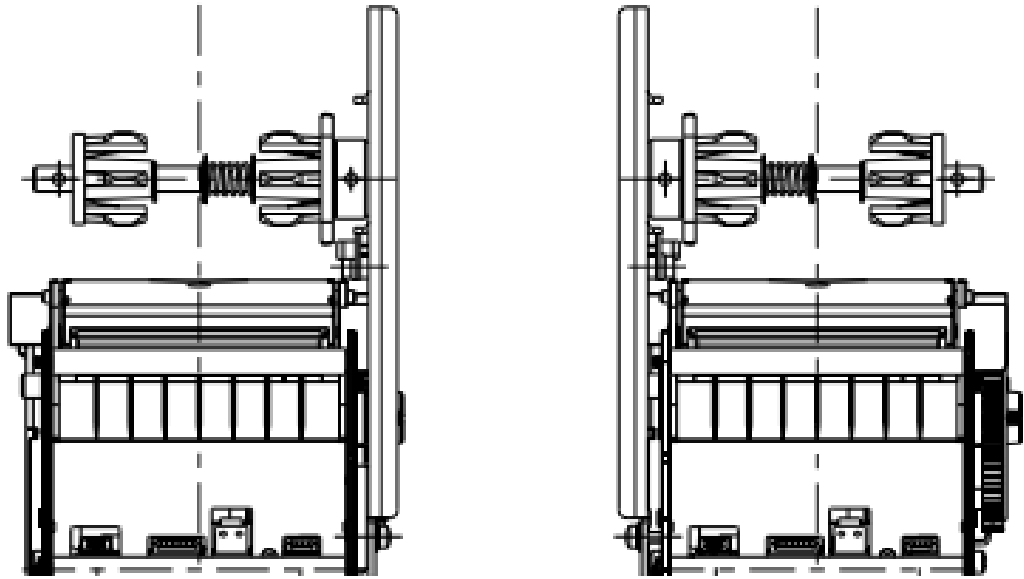
The spindle accepts a 1" inner diameter of the paper roll and it can also be mounted at two different locations depending on your installation needs. See the dimensional drawing for details.
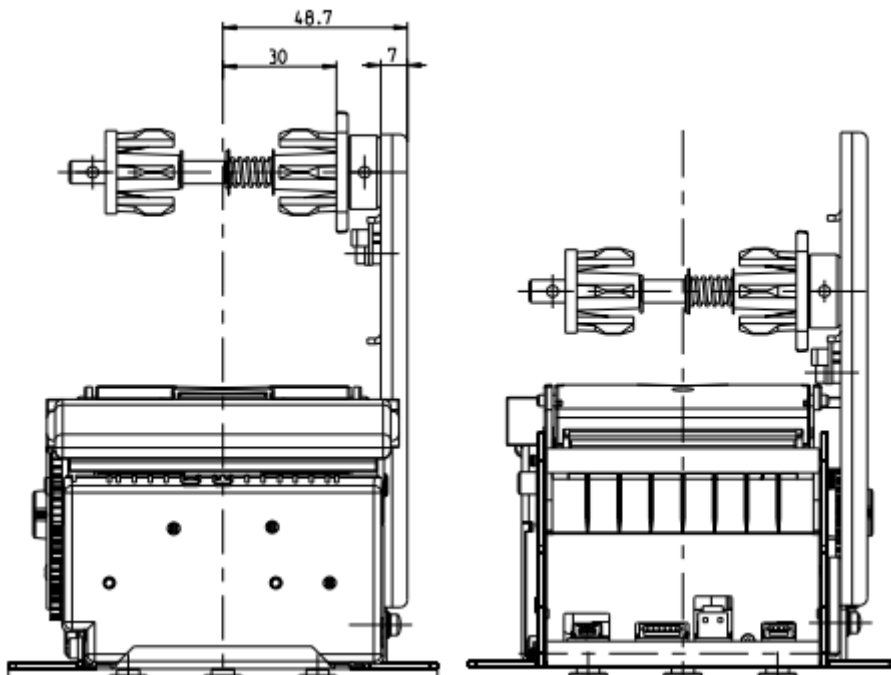
4.6.2 Designing Your Own Paper Roll Holder

It is sometimes desirable for customers to design their own paper roll holder in order to fit in the available space, or to tailor performance to their specific needs. Based on our extensive experience in designing printers, we would urge you to consider the following topics and implement your design with care.

Large Diameter Rolls: When using paper rolls over 150 mm in diameter, a "dancer bar" may 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 usually causes 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 spindle and 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 or printer, as witnessed numerous times.

4.7 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 high currents for very short time periods. 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 24 VDC applications.

DC Output Voltage: 24 volts ± 5%
DC Output Current: 6 Amps (=120 Watts nominal)
Hold Up Time: 25 ms minimum
Current Limitations : 16 Amps minimum

4.8 Electrical Design Aspects

An important aspect of the electrical design is about grounding. The high currents during printing require a solid grounding concept. Typically, the power supply for the printer and for the computer are separate units with individual grounding. Therefore, the more important it is to **keep both grounding levels closely together**.

☞   It is recommended to locate common groundings as close to the printer power connection as possible rather than at the power supply location. High currents can generate high voltage shifts on long supply wires. Such high voltage shifts of up to several Volts may cause high compensation currents which search way through the communication cable (USB, RS232) from the printer to the computer leading to distortions in communication or even damage of components.

5 Operation

5.1 Loading Paper - Autoload

The eXtendo® XF series of thermal printers automatically loads paper when it is inserted. First, make sure that the printhead is in the "down" position by pushing the Printhead (3a) down until it snaps into place on both sides of the chassis. Then insert the paper, thermosensitive side up, into the paper entry area (2) in the rear. You will hear the feed motor start to run as soon as the paper detection sensor is reached. Continue to feed the paper until the platen grasps it and pulls it into the printer.

Please note that the eXtendo® XF thermal printer family will, unless specifically configured not to do so, will print a configuration and diagnostic report immediately after paper has loaded. An example of such an "Info Printout" is shown on the right. This short report is extremely helpful during setup and configuration of the eXtendo® XF printer. It contains detailed information about the printer itself, date of manufacture, feature sets, firmware version, flash memory contents, and other data representing your printer's configuration setup.

One example of how this report can be used involves the serial baud rate settings of the printer. If you want to verify the current serial settings (baud rate, stop bits, parity, etc.), simply remove and reload the paper. RS232 settings are printed as part of the Info Printout. Please note that many of the software tools supplied with the eXtendo® XF driver also allow this report to be printed by command without removing the paper. Simply click on the "Print Info" button.

☞ **HINT**: In case the automatic Info Printout is disabled on your printer, you can generate a report when you unlock and lock the printhead (3a → Fig. 2) three times.

☞ The eXtendo® XF 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.

5.2 Printhead Lock

The printhead locking shaft (3a) is used to unlock and raise the printhead holder with the thermal print head. This allows easy access of paper path and print head in case of paper jam conditions or cleaning or other investigation. For the printer to be ready for printing or paper loading, both ends of the locking shaft must reside in their latched down position.

Leaving the printhead in contact with the platen for a long period of time without paper under the printhead may rarely cause a temporary indentation in the platen, which can result in initial feeding difficulties when loading paper (sometimes called "rattle snake noise"). If this occurs, simply open and close the Printhead and re-load paper or just turn the blue paper advance wheel (7) by hand to overcome the indentation.

5.3 Paper Advance Wheel

The eXtendo® XF family of printers is equipped with a Paper Advance Wheel to make it simple to manually advance paper when needed (→ Fig. 5). Rotating this wheel counterclockwise (the direction labeled "Paper In" on the wheel) will draw paper in from the paper supply at the rear of

the printer. Rotating the wheel clockwise (the direction labeled "Paper Out" on the wheel) will cause paper to back out of the rear of the printer.

Note: Under normal conditions, the Paper Wheel will not be used. Paper must be loaded with the automatic paper load function in order to be detected properly. See *5.1 Loading Paper*.

5.4 Print Speed

Print speed is affected by many factors. First, the maximum print speed is dependent upon the operating version of the eXtendo® XF version that you ordered. Even with the maximum print speed in the firmware set to 250 mm/sec, the 12 Volt models will not exceed 130 mm/sec. Other significant factors affecting print speed include:

- Type of interface / ASCII printing vs. Graphics printing
- Baud rate settings when using RS232
- Density settings
- Dot history factor
- Multi-strobe factor (usually not needed)

5.5 Cutter Operation

The cutter used in the eXtendo® XF series printer is a Twincut guillotine type.

It is motor driven and use internal cam action to provide feedback as to when the cutter has returned to its home position. Twincut versions with full and partial-cut capability can make full or partial cuts under software control. Technical specification sheets on standard versions of the cutters themselves are available upon request from Hengstler.

Please note that, when dealing with an eXtendo® XF with the Twincut guillotine cutter, the cutter blades can be manually moved without removing the cutter cover. Simply insert a small, flat bladed screwdriver in the screw slot located in the area circled in Fig. 12 and turn. This will manually turn the motor, moving the blades. This is useful in clearing paper jams.

Please be sure to remove power from the printer before manually moving the cutter blades, and keep your fingers clear of the blades themselves.

Figure 12

5.5.1 Partial Cut with Chute Sensor

The behavior of the eXtendo® XF family of printers when using the full- and partial-cut guillotine version of the cutter is different when a partial-cut is made. The platen motor is locked after the partial cut is made to make it easy to tear the remaining paper tab and to prevent vandals from pulling the paper off the paper roll inside the printer. After

approximately 30 seconds, if the sensor detects that the paper has not yet been taken, the printer will do a full cut to foil any vandals.

☞ When the printer is not equipped with a chute sensor, the partial cut function is not recommended because there is no means in detecting "receipt taken".

5.6 eXtendo® XF Digital Tools

The eXtendo® XF family of thermal printers includes with the Windows driver a series of very useful tools. These can be run directly from the folder ".\tools "of the driver package once the driver has been installed and a printer has successfully connected. A brief summary of some of the tools is as follows.

eXtendo® Configuration Tool: A very important tool that allows you to change virtually any variable setting or performance characteristic of your eXtendo® XF printer, e.g., paper format control parameters, default print speed, dot history settings, individual serial numbers etc.

eXtendo® Command Tool: Very simple tool for sending Native Commands to the printer. Can be used to experiment and build complete ticket sequences.

eXtendo® Print Terminal: Possibly the most useful tool of the bunch, the Print Terminal has 12 sets of 24 buttons each, part of them pre-programmed with useful commands. All buttons are programmable to make them transmit whatever is needed by a single click. It also provides a display that show the transmitted data as well as the printer's responses, e.g., upon status request commands.
Both, Command and Print Terminal Tools are very popular with software developers who are integrating the eXtendo® XF into their products.

eXtendo® Diagnostic Tool: A useful tool for identifying possible issues with your printer, its peripherals and firmware. Provides all sensor information as well as a test bench for endurance testing and for black mark testing.

eXtendo® Font Tool: Used for uploading and assigning different fonts within the eXtendo® XF printer. You can modify fonts or use pre-defined code page bundles.

eXtendo® Image Tool: This tool creates eXtendo® XF upload files from standard graphic files so they can be uploaded as stored images.

eXtendo® Uninstaller Tool: Use this tool to uninstall single or all versions of the eXtendo® XF driver.

eXtendo® Upload Tool: Used to upload firmware and other upload files (image/logo files, font files) into the flash area of your eXtendo® XF printer.

eXtendo® Wide Font Tool: Used for creating Wide Font formats (such as Chinese or Korean) from standard graphic files.

6 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 eXtendo® XF to a lower current mode when the system switches to battery operation. The following are some considerations to aid in reducing current draw.

☞ For all items described in the following, please refer to the eXtendo® XF Emulation Command Set Reference D 684 112 or the eXtendo® Configuration tool for a comprehensive view.

6.1 Print Speed

With thermal printers, average current is about 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 target print speed can be set via command or the configuration. The slower this print speed is, the lower the current draw will be. Note that when printing via the eXtendo® Windows driver, print speed and density settings come from the settings of the driver (see under "Devices and Printers") and overrule the printer internal settings.

6.2 Graphics/Bar Codes

Printing graphics typically consumes more current than printing only text. Text-only printing is considered to have ~15% dots coverage on average, while graphic or barcode printing may go up to 50%, consuming 2x to 4x the average current.

6.3 Inverse Printing

Inverse text printing should be avoided when current matters, since everything that's normally black becomes white, and vice-versa, is drawing (in average text) about 6 to 8 times the current and is therefore comparable to full-black printing.

6.4 Print Density Adjustment

Increasing print density can improve print quality / blackness, but at the same time will increase current draw. 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.
Note: increasing the print density can adversely affect the print heads' life.

6.5 Dot History Factor

The eXtendo® printers offer a feature to improve the sharpness of printouts, e.g., when printing long barcode sequences of for documents containing small text.
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. But it also increases the burn time for "new" dots in a row.
When using dot history, it is recommended to increase the density setting by 50…70% of the dot history factor. help reduce average current draw but primarily increases print image sharpness.
Note: the effect of dot history settings depends on the quality of the used thermal paper.

6.6 Multi-Strobe Factor

This feature is an eXtendo® XF software feature that can help reduce **peak** current. When the double-burn feature is turned on, only half of the printhead is fired at a time, reducing the peak current by ~30%, but having virtually no effect on average current. This can in rare cases be useful if your power supply or connectors have a restrictive maximum current but note that this setting limits the print speed.

7 Troubleshooting

Symptom	Possible Cause	Corrective Action
No LEDs light on printer	1. Power not connected or with wrong polarity.	1. Check line cord and power supply outlet
LEDs flashing	See Section "LED Indicators"	See Section "LED Indicators"
Printer will not feed paper	1. Print head raised (LEDs will flash; see Section "LED Indicators")	1. Push the printhead down until it locks on both sides
Printer will not load paper and makes loud noise	1. Printer left with no paper under printhead for long time.	1. Raise printhead, manually turn blue wheel, lower printhead
Printer prints blank paper	1. Paper inserted upside-down 2. Wrong side of roll coated	1. Invert paper roll 2. Invert roll as test, have paper made properly
Print quality poor	1. Print density set too low 2. Unsuited thermal paper	1. Adjust print density settings, other burn time adjustments. 2. Use verified paper
Baud rate, other configuration setting changes not effective after use of Configuration Tool	1. Printer and computer not reset/rebooted after changes made with Configuration Tool or on computer COM port.	1. Reset or repower the printer. 2. Reboot computer for COM settings to take effect. Alternatively run "net stop spooler" and "net start spooler" in a command window (un com with admin rights).
Paper will not load	Paper in chute	1. Remove paper from the exit area of the printer. 2. Check the exit sensor status with the diagnostic too.

8 Maintenance

The eXtendo® XF printers are intended to be maintenance-free, and as such do not require any regular service or maintenance.

9 Support and Repair

For details, and to arrange for the return of a printer for repair, please contact us by using the online RMA procedure which you can find on our webpage (https://www.hengstler.de/de/support/reparaturanfrage.php or https://www.hengstler.de/en/support/repair_request.php).
After providing all basic information in the RMA form, you will receive instructions and a shipping label for your package.

If you need technical support or help you will also find contact information on the webpage described above. When you click on the tab "Support", you can find an online form that you can fill in and send to the Hengstler support team. You will also find a phone number where you can speak to a support team member during business hours.

☞   Please have part number "0684…", serial number and date of manufacturing available. These can be found on the product label. In many cases it is also helpful to know the firmware version. All needed information can also be found on the Information Printout of your eXtendo® XF printer (→ "*5.1 Loading Paper*").

10 Buying Paper

10.1 Sourcing Paper

In order to maintain your warranty, use only paper that conforms with eXtendo® XF Paper Specification D 684 122. Use of paper that does not conform with this specification may adversely affect the performance of your eXtendo® XF printer and/or damage your printer. Please note that the eXtendo® XF can use either roll or fanfold paper. When using fanfold paper, care must be taken to configure the printer, black or hole 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.

10.1.1 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 eXtendo® XF printer conforms with eXtendo® XF Paper Specification D 684 122.

10.2 Mark Sensor Locations

eXtendo® XF printers support three different black mark positions on the (non-thermal) bottom side of the paper. The sensor location must be known at time of ordering the printer and will be fixed at time of manufacturing. The number inside the boxes refers to the printer's match code that you would see on quotations.

Black Mark Sensor Locations:
Pos 6   (**standard**, 9 mm from right edge; match code example: *X56-US-P-**06**-J-...*)
Pos 1   (25.6 mm from right edge; match code example: *X56-US-P-**01**-J-...*)
Pos 4   (16 mm from left edge; *X56-US-F-**04**-J-...*)

Hole Sensor Location:
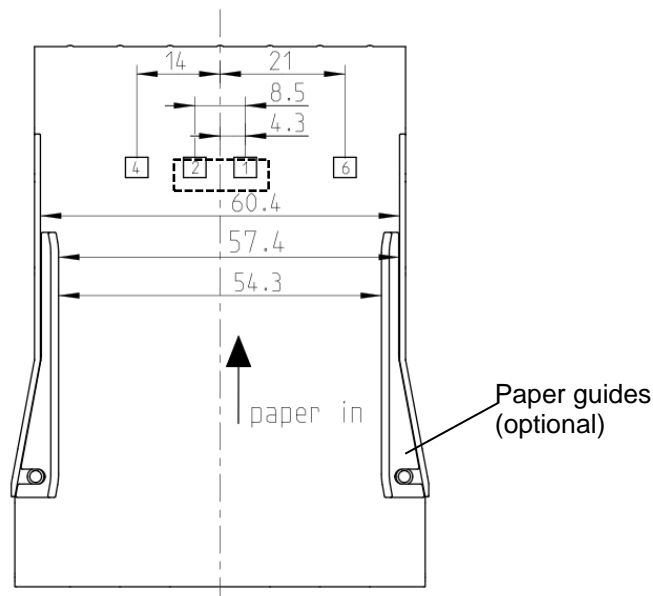**Pos 1+2** (center position T1, hole must be 12 mm wide min.; match code ex. *X56-US-F-**T1**-J-...*)

Figure 13

11 Technical Specifications

Technology:	Direct Thermal
Resolution:	203 dpi (8 dots/mm)
Paper Weight:	50 to 120 g/m² (Twincut cutter; partial/full cut model) 50 to 160 g/m² (Twincut cutter; full cut only model)
Cutter:	Hengstler Twincut Guillotine Type, full or partial cut 1.5 mio cuts
Data Interfaces:	a) USB 2.0 industrial Transmission rate: 1.5 Mbit/sec and 12 Mbit/sec
	b) RS-232 4,800 to 115,200 baud
☞	Data cable length (any) max 3 meters. DC supply cable length max. 3 meters. No DC building power supply; compare warnings in *section 11.1 Electromagnetic Compatibility*. Any receiver inputs < 13.2 Volts
Bar Codes:	UPC-A, UPC-E, EAN-13, EAN-8, Code 39, Interleaved 2 of 5, Code 128, Codabar 2D: PDF417, QR Code, Datamatrix, Aztec
Minimum Print Length:	15 mm. Note: At least 40 mm should be printed in order for the paper to be visible. Down to 15 mm ticket length is possible to allow for applications where the printer is used without or a chute and where very short printouts are dropped into a bin or similar conveyance.
Temperature Range	
Operating:	-25°C to +65°C 20% to 85% RH non-condensing
Storage:	-30°C to +75°C (versions with coated pcb upon request)
Printhead Life	
Abrasion:	150 km of paper (*based on 12.5% print density*)
Electrical:	150 million dot pulses
Paper Roll Capacity:	Optional Roll Holder with up to 200 mm roll diameter and 1 inch spindle
Graphic Driver:	Windows® 7/8/10, Linux (CUPS, ARM, 64-bit)
Firmware:	Field uploadable firmware, configuration, character sets, predefined graphic images
Approvals:	CE, UL E174318 (pending)
Print Speed:	24 VDC: up to 250 mm/sec (13.7 ips) max. 12 VDC: up to 130 mm/sec (5.1 ips) max.
Paper Width:	54-60 mm (2.12 to 2.36 inches) As an option a pair of paper guides is available for a 54 mm setup (e.g., credit card formats)

Printable Width:	56 mm (2.20 inches)
Operating Voltage:	24 VDC ±5 % or
	12 VDC (10-15 VDC); optional
Power Supply (recommandation)	120 W, 25 ms holdup time (16 Amps peak)
Peak Duty Cycle:	max 15 printouts per minute; ticket length 150 mm max..
Current Draw:	
In standby, approx. :	40 mA
While printing:	@21°C, print speed 100mm/s; current in Amps avg.

	dots/pixel coverage		
	12.5%	25%	50%
24 VDC	1.0	1.6	2.8
12 VDC	0.9	1.5	2.6

Dimensions (W x H x D)	96 x 75 x 132 mm (approx., without quick-fit hubs)
Shock and Vibration:	Vibration: DIN EN 60068-2-6
	Shock: DIN EN 60068-2-27 (for shipping purposes)

11.1 Electromagnetic Compatibility

11.1.1 FCC Part 15 Class A Device

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference 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.

11.1.2 EN55032 – Emissions

The eXtendo® XF family of thermal printers are class "A" appliances, and comply to applicable Class "A" standards, when installed in a properly grounded housing with appropriate conductive shielding.

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

11.1.3 EN55035 – 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 by EMI can temporarily cause corrupted printing or data loss.

HENGSTLER

12 Spare Parts and Accessories

Description	Hengstler part #
Serial Data Cable (9-pin Sub-D), 2 meters	E1684527
USB Data Cable (Mini-USB, straight connector), 1.5 meters	0684102
DC Power cable with connector and pigtail, 1 meter	E1684530
Paper Roll Holder Kit XF incl. PPE sensor (universally configurable)	E1684201
Mounting Bracket kit XF (kit of 5 pairs)	E1684202
Paper Guides XF (kit of 5 pairs)	E1684203
PPE-Sensor with 12 inch / 300 mm cable	E1684115
PPE-Sensor with 22 inch / 550 mm cable	E1684133
Paper Roll, 60 mm wide, 55 gr/sqm, outer/inner Ø 100 / 25.4 mm	3810859