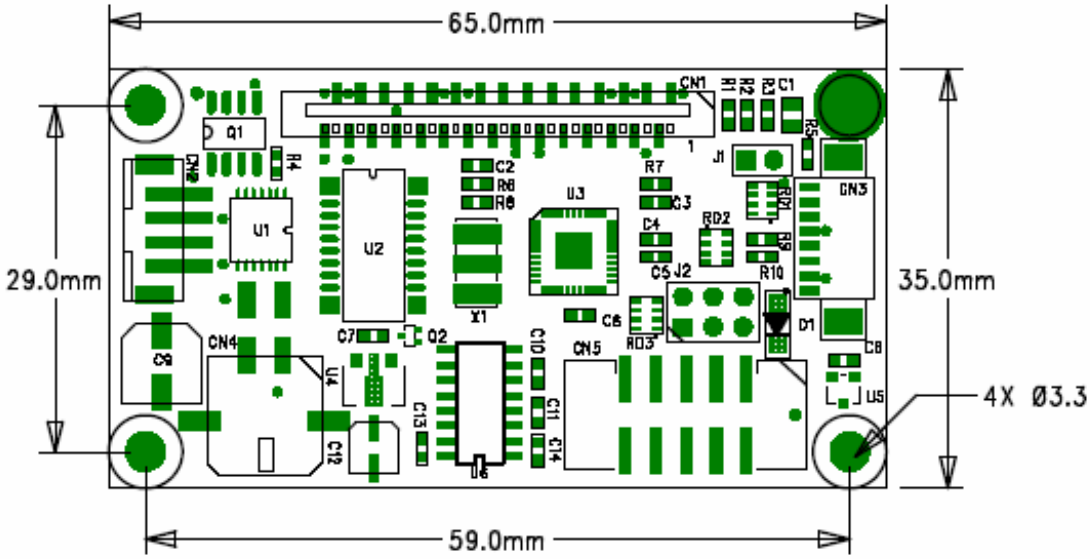
Users manual
Version 1.0



Thermal printer controller

PRN608-038

FOR FUJITSU THERMAL PRINTERS

FTP-628MCL1xx FTP-638MCL1xx

FTP-628MCL3xx FTP-638MCL3xx

Trentino Systems

Version history

Version	Date	Init	Status	Description
1.0	060202	BB	Closed	First release

PRN608-038 is RoHS compliant

Safety Precautions

- Please read and understand these specifications thoroughly before using the printer. Please keep the specifications carefully in a place where they may be easily consulted when the printer is used.
- Please do not modify or service this printer as this may cause unpredictable faults to occur.
- The product is not intended to be installed in devices such as those used in life-support medical equipment, undersea relays, and aerospace applications or for nuclear power control, in which extremely high reliability is required. If you are considering such applications, please consult our customer service department.
- There is a general possibility of component failure. Every effort has been made to improve product quality but such failures cannot be completely excluded. Please assume that such failure may occur before using this printer.

We would urge that these specifications should be thoroughly understood and the printer used safely in your company or associated organization. Please indicate or describe in your products and in the user manuals those items, which are related to the prevention or avoidance of danger and draw these to the attention of the eventual client (the user).

This manual may only be used as appendix to the product and may only be used, as a help to better understand the functionality of the product. Any approval of the product may only be done based upon sample of the product. Approval based upon the specification is not accepted by Trentino Systems ApS.

1 SYSTEM DESCRIPTION

This reference manual describes the specifications, functions, and operating procedures for the PRN608-038 interface board.

PRN608-038 is designed for the following Fujitsu printers:

FTP-628MCLxxx FTP-638MCLxxx

PRN608-038 consists of an interface board.
The communication is RS232,
115200 baud, 8 bit,
1 stop bit, no parity.
Handshake, hardware

PRN608-038 prints graphic data either compressed or non-compressed.
Burn time can be set to control the printing intensity.
Windows 2000, XP drivers are available upon request.

2 INSTALLATION

2.1 Unpacking

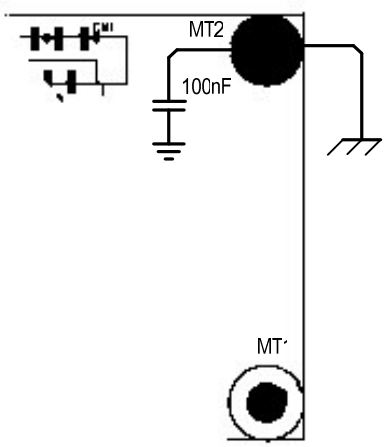
Remove the cover observing precautions for Electro Static Discharge (ESD). Make sure that the board is handled with care with respect to Electrostatic environment.

2.2 Labels

PRN608-038 has 3 labels;
Label 1 on backside ex. Ifxxxxxx is a unique ID number. For service and question based upon 1 particular board please refer to this number. Label 2 on topside ex. PRN608-038 is part number. Please refer to this number upon reordering. Make sure that software revision is applied at same time.
Label 3 is an internal code. Please ignore

2.3 Installation

Due to (ESD) electrostatic discharged risk is it highly recommended that the PRN608-038 is fastened in the application by 4 M3 screws.
The cables (for the thermal head, the stepper-motor and detector) are placed in the thermal printer connector on the PCB.
The cables for the power supply and serial communication are placed in the serial/power connector.
The mounting hole MT2 is decoupled electrical grounded by a 100nF capacitor.



(a) To connect or remove the connector, always turn off the power in advance. If the connector is connected or removed while the power to the printer is on, errors may occur.

(b) The connector of each cable must be correctly locked and connected. The connector at the head side has no lock feature. Check that the connector at the head side is completely inserted.

(c) To install the interface, carefully check each cable so that excessive force is not applied to each cable. Especially, carefully check the head connection cable because it affects the head pressure force. If the print head connector is not completely connected, overheating or burning may occur in the print head.

(d) Be sure to add grounding cable from printer body to interface ground. Make sure that ground is present at any mechanical settings, like head up and paper out.

2.4 Power supply

The nominal supply voltage the PRN608-038 controller board is 6-8,5VDC, with ±10 % in tolerance. Make sure that voltages never exceed the specified tolerance.

(a) The power supply unit that satisfies the specifications must be used. If a power supply unit that does not satisfy the specified specifications is used, normal operation is not assured and errors may occur.

(b) To turn on or off the power, a protective circuit must be mounted on the control board in advance. For safety, the following voltage change conditions must be satisfied.

3 SPECIFICATIONS

Interface	Serial RS232
Data format	115200 baud, 8 data bit, no parity, 1 stop bit
Handshake	RTS-CTS
Command set	Trentino Systems
Logic supply	None (internal switch supply)
Printer supply	+6-8,5VDC
Power on self test	Feed 2mm
Voltage compensation	Burn time
Power down	Hardware
Current consumption	Standby up to 100mA
Current limit	Programmable
Printing speed	Average 40mm/sec, Max 60mm/sec
Font set	Western (Code 850, char 32-159)
Character size	16x32, 16x64, 32x32, 32x64, 64x128
Character type	Normal, Underline, Reverse (white on black)
Default font	16x32
Paper detect	Digital
Barcode	Code 39
Barcode height	20mm
Graphics	Normal / Compressed
Auto load	50mm
Form feed	20mm
Line feed	LF
Maximum dimensions	35*65mm
Mounting holes	4x Ø3.3
Weight	9g
Temperature	Storage -40°C to +85°C 0-90%RH, Operating 0°C to +70°C 10-90%RH
Shock	100G XYZ
EMC	Emission: E-Field EN50081-1-1, Conducted EN50081-1-2
	Immunity: E-field EN50082-1-1, Conducted EN50082-1-2, Over voltage EN50082-1-3
Drivers	Windows 2000/XP
Approvals	CE, UL

4 FUNCTION

4.1 General

Notice; when data is send from the external equipment to the printer controller, all data has to be sent. The data must be sent as a binary file. If the data are sent as a character file, and some data in the file is equal to EOF, the rest will not be received.

4.2 Auto form feed

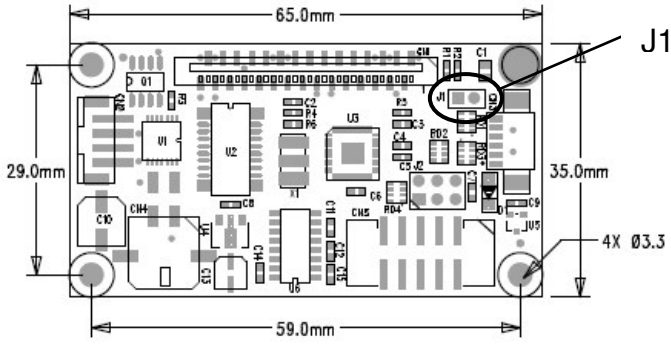
When paper is out, it is possible to form feed new paper automatically. While the thermal head is down, place the paper at the roller.
After 0.5 seconds the paper will be pulled in automatically.
Form feed length is factory set.
The controller board cannot detect paper during Low current power down.

4.3 Auxiliary input

It is possible to connect an extra opto-sensor and switch to the board. Both levels can be read be requesting status.

4.4 Firmware upgrade

Firmware can be upgraded. In case firmware upgrade is needed Trentino Systems will provide windows utility and the firmware.
In order to upload new firmware to the PRN608-038 board, the jumper J1 must be shorten.



Further instruction concerning firmware upgrade comes along with the utility and the firmware from Trentino Systems.

4.5 Printing characters

ASCII-characters (from 32 to 159) can be printed. A character line is 6-48 characters long (depending on font size). If LF (character 10) has been received, a carriage return will occur.
A line will be printed when 6-48 characters has been received or when a LF are received.

Underline

The last line in character matrix will be marked when underline characters are printed.

Reverse

Character matrix will be negated when reverse characters are printed.

Font size

Font	Width	Height
Normal	Double	Double
Wide	Double	Quadruple
High	Quadruple	Double
Large	Quadruple	Quadruple
Xlarge	Octuple	Octuple

A build-in smooth function is implemented to obtain best character quality.

4.6 Control and Escape sequences

The control of the PRN608-038 printer interface is performed by a command set of escape sequences. The following commands are used. All other commands are ignored.

Escape sequences, overview

ESCAPE SEQUENCES, ASCII	FUNCTION
ETX	Normal Font
EOT	Wide Font
ENQ	High Font
ACK	Large Font
BEL	Xlarge Font
BS	Partial cut
LF	Line Feed
VT	Barcode on
FF	Forward feed
SO	Reverse off
SI	Reverse on
DLE	Underline off
DC1	Underline on
SYN	Reset printer
ETB	Request software version
CAN	Request status
EM	Request voltage
SUB	Request temperature
ESC+n	Set auxiliary output
GS	Feed Paper
RS	Burn compensate
US	Print graphic line

Normal font (16x32)

[Name]	Normal font (16x32 dots)	
[Format]	ASCII	ETX
	Hex	03
	Decimal	3
[Description]	Select normal font from the current print position. This is the default font from power on or reset	

Wide font

[Name]	Wide font (32x32 dots)	
[Format]	ASCII	EOT
	Hex	04
	Decimal	4
[Description]	Select the wide font from the current print position.	

High font

[Name]	High font (16x32 dots)	
[Format]	ASCII	ENQ
	Hex	05
	Decimal	5
[Description]	Select the high font from the current print position.	

Large font

[Name]	Large font (32x64 dots)	
[Format]	ASCII	ACK
	Hex	06
	Decimal	6
[Description]	Select the large font from the current print position	

X-large font

[Name]	Xlarge font (64x128)	
[Format]	ASCII	BEL
	Hex	07
	Decimal	7
[Description]	Select the X-large font from the current print position.	

Partial cut

[Name]	Partial cut	
[Format]	ASCII	BS
	Hex	08
	Decimal	8
[Description]	This byte performs a partial cut is.	

Line feed

[Name]	Line feed	
[Format]	ASCII	LF
	Hex	0A
	Decimal	10
[Description]	Line feed.	
[Notes]	Print the data from the buffer and feed the paper.	

Barcode on

[Name]	Barcode on	
[Format]	ASCII	VT
	Hex	0B
	Decimal	11
[Type]	Barcode 39	
[Description]	Enable barcodes until a non barcode character received.	
[Barcode char.]	Space , $, % , * , + , - , . , / , 0-9 , A-Z	
[Notes]	The barcode 39 must start and end with the character '*'. This character is the start and stop character in barcode 39, and '*' can only be used as start and end character. If the barcode length exceeds the paper size the last barcode character will not be written as barcode. In that case the barcode cannot be read because the last character will not be '*'.	

Feed Forward

[Name]	Feed Forward	
[Format]	ASCII	FF
	Hex	0C
	Decimal	12
[Description]	Print data from buffer and feed forward 50mm	

Roff

[Name]	Reverse off	
[Format]	ASCII	SO
	Hex	0E
	Decimal	14
[Description]	Switch off the reverse printing	

Ron

[Name]	Reverse On	
[Format]	ASCII	SI
	Hex	0F
	Decimal	15
[Description]	Switch on the reverse printing	

Uoff

[Name]	Underline off	
[Format]	ASCII	DLE
	Hex	10
	Decimal	16
[Description]	Switch off underline printing	

Uon

[Name]	Underline on	
[Format]	ASCII	DC1
	Hex	11
	Decimal	17
[Description]	Switch on the underline printing	

Reset printer

[Name]	Reset printer	
[Format]	ASCII	SYN
	Hex	16
	Decimal	22
[Description]	Reset the printer. The command is performed even though RTS is busy.	

Request version

[Name]	Request version	
[Format]	ASCII	ETB
	Hex	17
	Decimal	23
[Description]	Software version number will be transmitted. The command is performed even though the RTS is busy.	

Request status

[Name]	Request status	
[Format]	ASCII	CAN
	Hex	18
	Decimal	24

[Description] Status byte will be transmitted. This command is treated even though RTS is busy. The bit definitions are as follows:

Bit	Status	0	1
0	Aux Opto	Low	High
1	Paper	Present	Absent
2	Temperature	Not too hot	Head too hot
3	Head	Closed	Open
4	Cutter	No error	Error
5	Rx error	None	Error
6	Aux Switch	Low	High
7	Always 1		

A request status will clear bit 5 if a RX error have set it.

Even though an RX error has set bit 5 the command request status will clear the bit.

Request analog voltage

[Name] Analog voltage
[Format] ASCII EM
Hex 19
Decimal 25
[Description] Transmit the digital value of the head voltage This command are treated even though RTS is busy.

Voltage	Returned Value
4.5	TBD
5.0	TBD
5.5	TBD

Request temperature

[Name] Request temperature
[Format] ASCII SUB
Hex 1A
Decimal 26
[Description] Transmit the digital value of the head temperature. This command is treated even though RTS is busy.

Temperature	Returned Value
0º	TBD
10º	TBD
20º	TBD
30º	TBD
40º	TBD
50º	TBD
60º	TBD
70º	TBD

Set auxiliary output

[Name]	Set auxiliary output		
[Format]	ASCII	ESC	n
	Hex	1B	n
	Decimal	27	n
[Description]	When this command is received then the auxiliary output can be set.		
	The bit definitions of n are as follows:		
	Bit	0	1
	0 LED	Off	On
	1 Solenoid	Off	On
[Default]	n=0		

Feed

[Name]	Will do a form feed of specified length		
[Format]	ASCII	GS	n
	Hex	1D	n
	Decimal	20	n
[Range]	-128<=n<=127		
[Description]	If n is negative the printer will make a reverse form feed. The unit of n is 1/8 mm.		

Burn

[Name]	Burn compensation		
[Format]	ASCII	RS	n
	Hex	1E	n
	Decimal	30	n
[Range]	-50<=n<=50		
[Description]	Compensate the burn time to obtain best quality.		
	If the printout is to dark a negative value should be chosen.		

Graphic data - non compressed

[Name]	Print 48 byte dot line graphics		
[Format]	ASCII	US	d1..d48
	Hex	1F	d1..d48
	Decimal	31	d1..d48
[Range]	0<=n<=255		
[Description]	This command will print the 48 bytes as a dot line.		

Graphic data - compressed

[Name]	Graphic data - compressed		
[Format]	ASCII	X	d1,d2,..,d(-X)
	Hex	X	d1,d2,..,d(-X)
	Decimal	X	d1,d2,..,d(-X)
[Range]	X:[-48;-2] d:[0-255]		
[Description]	When the printer controller receives a byte that is -48 to -2 (Decimal 208 to 254) the following data is compressed data. The number of compressed graphic bytes is the negative value.		

Example:
If X = -10 (Decimal 246) the next 10 bytes is compressed data.

The compressed data is as follows:
When a data byte is 0 (no dots activated) the next byte received is the number of bytes that are 0. All other data is sent as non-compressed.
To benefit from data compression the data must excite a certain amount of lines. Very few lines cannot be compressed. It will result in a longer data string than non-compressed data.

An example on a dot line that must be sent as non-compressed:

```
0,1,0,1,0,1,0,1,0,1,0,1,0,1,0,1,0,1,0,1,0,1,0,1,0,1,
0,1,0,1,0,1,0,1,0,1,0,1,0,1,0,1,0,1,0,1,0,1,0,1,0,1.
```

Here below follows two beneficial examples of data compression:

Example 1:
Dot line data to be transmitted:

```
0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
```

This will be compressed to

```
-2,0,48
```

Example 1:
Dot line data to be transmitted

```
128,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,128,
1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1
```

This will be compressed to

```
-8,128,0,22,128,1,0,22,1
```

5 MAINTENANCE

5.1 Daily use

The PRN608-038 board must be turned off in idle mode.

5.2 Store/Transport

The product has to be stored under ESD safe conditions, and to be packed safely during transportation.

6 SPECIFICATIONS

6.1 Electrical data

Voltage:	Nominal	5V DC
	Tolerance	±10%
Current:	Max. head current:	Numbers of active dots * VHead 180+/-15%
	Max. motor current:	500mA
	Max. low current in power down mode:	0.3mA (approx)

6.2 Mechanical data

Dimensions:	L * W * H:	65 mm* 35 mm* max.10 mm Including connectors
Vibration:	XYZ	100G
Shock:	XYZ	100G

6.3 Environmental data

Operation:	Temperature:	0℃- +70℃
Humidity:		10%-90% RH, without condensation
Storage:	Temperature:	-40℃ - +85℃
	Humidity:	0%-90% RH, without condensation
Transport:	Temperature:	-40℃ - +85℃
	Humidity:	0%-90% RH, without condensation

6.4 EMC & ESD

The printer controller is tested according to:

Emission:	E-Field:	EN50081-1-1
	Conducted:	EN50081-1-2
Immunity:	E-field:	EN50082-1-1
	Conducted transients:	EN50082-1-2
	Over voltage:	EN50082-1-3
Medical equipment:		IEC601-1-2

6.5 Connector pin assignments

Head/motor/switch connector CN1:

Part number: CF16301M0T0, CviLux Corporation.
Mating part: Flex Flat cable

Pin	Function	Pin	Function
1	GND	16	TI
2	VDD	17	/ST2 / GND
3	P1	18	/ST1
4	GND	19	/ST1
5	SW	20	AOE
6	VH	21	GND
7	VH	22	GND
8	DI	23	/LAT
9	CLK	24	DO
10	GND	25	VH
11	GND	26	VH
12	/ST3	27	/MB
13	VH	28	MB
14	/ST1	29	/MA
15	VDD	30	MA

Cutter connector CN2

Part number: B4B-PH-SM3-TB from JST
Mating part: Supplied with cutter

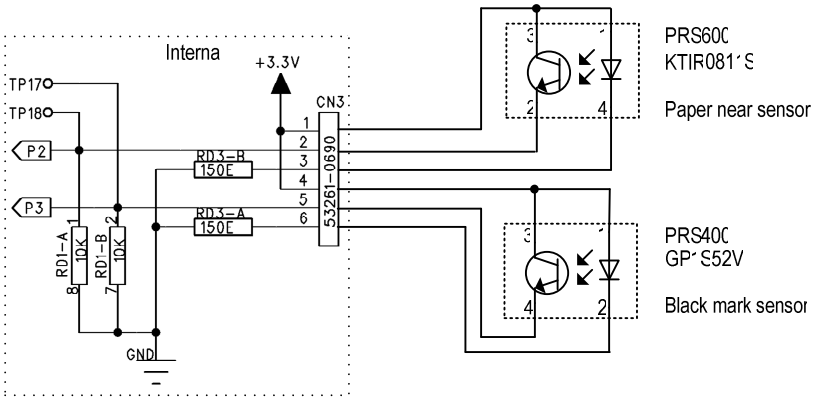
Pin	Function
1	+3.3V
2	Sense
3	CUT
4	/CUT

AUX input connector CN3

Part number: 53261-0690, Molex
Mating part
Part number:
Housing: 39-01-3042, Molex
Contact: 39-00-0038, Molex

Pin	Function
1	+3.3V
2	Input 1
3	150Ω resistor to ground
4	+3.3V
5	Input 2
6	150Ω resistor to ground

The schematic below show how the external opto-sensor and paper switch must be connected to the PRN608-038 board.



Power connector CN4:

Part number: 43045-0409, Molex
Mating part
Part number
Housing: 43025-0400, Molex
Contact: 43030-0007, Molex

Pin	Function
1	GND
2	+5V
3	GND
4	+5V

Serial Connector CN5:

Connector type: LPH10-SGN1-PAD
Mating connector part number: FC10AGN, Taitek

Pin	Function	Direction	Pin	Function	Direction
1	NC	-	2	DSR	output
3	TX	output	4	CTS	input
5	RX	Input	6	RTS	output
7	DTR	input	8	NC	-
9	GND	-	10	NC	-

6.6 Mechanical drawing