MFC101C

RS232 Interface for Coin Validators

User Manual

Version 1.1

1.0 Introduction

The MFC101 is an RS232 interface module for most models of coin acceptor products. The MFC101 has a built-in true RS232 port on its uplink communication port to interface with the serial port on a PC and a multi-purpose downlink port to interface with validators. On the multi-purpose downlink port, the circuitry is made to accommodate a large variety of coin validators based on the selection of 6 hardware jumpers. With the MFC101, the end operator can treat all different kinds of validators as a standard RS232 device and can concentrate on the real operation of the validator rather than the tedious interface work of the hardware discrepancy. On the PC platform, the software developer can easily program the validators via the MFC101 with common computer languages such as Visual Basic / C++.

1.1 Compatibility

MFC101 is a successor of the MF100C model. MFC101 is 100% software compatible to RS-TALK (a demo program to verify communication) and 100% functionality compatible to MF100C. With the introduction of the 6 hardware jumpers, a more versatile configuration can be setup to interface with over 90% of the most commonly used banknote / coin validators found in the market.

2.0 Communications

This interface is a three wire interface using a Transmit line (TXD), a receive line (RXD) and a Common line. The Host machine is thought of as being the Master device. The MFC101 is the slave device that responds only to the polls (or requests) from the Master.

In this polled system, the Master requests information from the MFC101 at a periodic rate. This rate can be as fast as every 30 milliseconds or as slow as the elapse time defined by the Lockout Timer. Faster rates are more desirable since overall system performance (in terms of bills/coins per minute accepted) will be higher at high poll rate system.

MFC101 has a “Lockout” Timer feature that it will disable the acceptor if the specified poll rate is not met. In another words, if the host system is too busy to keep up with the desired minimum poll rate, MFC101 will put the acceptor into the Disabled mode. The acceptor will be enabled again once the communication resumes.

2.1 GENERAL DATA

Baud Rate - 9600
Duplex - Half Duplex
Character Format
1 start and 1 stop bit
7 data bits (Bits 0 = sent first (LSB)
1 Parity Bit (Bit 7, Even Parity)
NRZ Format (Non-Return to Zero)

Lockout Timer — If the MFC101 does not receive a poll after an elapse time specified by the hardware jumper, it will:

1. Suspend (Disable) the acceptor.
2. Return any note being held in escrow (if applicable).

This Lockout Timer has a selection of 1 second or 20 seconds specified by the setting of a jumper J4. Refer to Section 4.2.3 for details.

Credit stack, Parallel Mode

MFC101 has a 6-level of credit stack in parallel mode. The stack is a FIFO type and holds up to 6 distinct credits and status information from the acceptor. On a slow polling system or whenever a communic ation loss occurs, credits issued by the acceptor are temporary stored in the MFC101 ram and to be released to the Master on future polls. When the 2nd level of stack is entered, MFC101 will disable the acceptor to avoid taking in any new tokens. Any credits already on the way sending from the acceptor will be piled up in the MFC101 stack.

Pulse chain, Pulse Mode

MFC101 has a pulse counter that can hold up to 261 pulses. Each pulse received from the acceptor is treated as an individual event. Thus, in another word, if a $20 dollar bill is accepted by a bill acceptor, 20 individual credits will be reported by the MFC101 in 20 consecutive events in its uplink communication. If the number of pulses is larger than 261, and the system is not polling fast enough to clear the stack, a stack overflow situation will occur. In such a case, the pulse count record is irrelevant to the credit accepted. But this is a rare case since no bill/coin acceptor will output so many pulses in normal circumstances.

2.2 MESSAGE FORMAT, UPLINK COMMUNICATION

Format: STX, Length, MSG Type and Ack #, Data Fields….., ETX, Checksum

Descriptions are as follows:

STX - 02h One byte indicating Start of message

LENGTH - One byte representation of the number of bytes in each message (binary), including the STX, ETX and the Checksum.

MSG TYPE and ACK # - One byte of Data

MSG Type - (Bits 4-6)

001 - for Master to MFC101 Message
010 - for MFC101 to Master Message
011 to 111 - reserved for future.

ACK # - (Bits 0-3)
00h or 01h

In the messages sent by Master, the Ack # is used to identify the message. The Ack # alternates between 00 and 01h. If the MFC101 receives two consecutive messages with the same number, the second message is treated as a retransmission of the first message.

In the messages sent by MFC101, the Ack # number is set the same as in the Master message to indicate the successfulness of the current message. If the MFC101 receives a message incorrectly (wrong checksum), the received message will be discarded and no message will be sent back.

DATA - The data portion of the message consists of the multiple data fields. We will discuss it in the section of DATA FIELDS.

ETX - 03h One byte indicating End of message.

CHECKSUM - A one byte checksum. The checksum is calculated on all bytes except the STX, ETX, and checksum byte itself. The calculation is done by XORing the bytes.

2.3 PC-to-MFC101 communications

Example: 02 08 10 7F 10 00 03 77

2.3.1 Data Fields

BYTE 0
For MFC101
Set to 00h – Disable acceptor
Otherwise – Enable acceptor

For future models with acceptor has programmable acceptance or escrow function.
Bit 0 - Enable 1st denomination channel
Bit 1 - Enable 2nd denomination channel
Bit 2 - Enable 3rd denomination channel
Bit 3 - Enable 4th denomination channel
Bit 4 - Enable 5th denomination channel
Bit 5 - Enable 6th denomination channel
Bit 6 - Enable 7th denomination channel
Set to 00h – Disable acceptor

BYTE 1
For MFC101
Set to 10h

For future models
Bit 0 - Reserved (set to 0)
Bit 1 - Not used (set to 0)
Bit 2 - Not used (set to 0)
Bit 3 - Not used (set to 0)
Bit 4 - Reserved (set to 1)
Bit 5 – Escrow Stack (= 1 causes bill to be stacked)
Bit 6 – Escrow Return (= 1 causes bill to be returned)

BYTE 2
For all MFC101 models
Set to 00h

2.4 MFC101-to-PC communications

Example: 02 0B 20 01 10 00 00 01 01 03 3A

2.4.1 Data Fields

BYTE 0
For MFC101
Bit 0 - Idling (= 1 if MFC101 have nothing to report)
Bit 1 - Reserved
Bit 2 - Reserved
Bit 3 - Reserved
Bit 4 - Stacked (= 1 if a credit was accepted)
Bit 5 - Reserved
Bit 6 - Reserved

For future models
Bit 0 - Idling (= 1 if nothing to report)
Bit 1 - Reserved
Bit 2 - Escrowed (= 1 if a banknote is in Escrow)
Bit 3 - Reserved
Bit 4 - Stacked (= 1 if a banknote was accepted)
Bit 5 - Reserved
Bit 6 - Returned (=1 if a banknote was returned)

BYTE 1
For all MFC101 models
Set to 00h

BYTE 2
For all MFC101 models
Bit 0 - Power up (= 1 if MFC101 experienced a reset since the last poll)
Bit 1 - Invalid command (= 1 if invalid command received)
Bit 2 - Failure (= 1 if acceptor has failed or cashbox full)
Bit 3-5 Credit Channel Field
000 = None
001 = 1st credit channel type
010 = 2nd credit channel type
011 = 3rd credit channel type
100 = 4th credit channel type
101 = 5th credit channel type
110 = 6th credit channel type, Pulse channel
111 = Reserved
Bit 6- Reserved (set to 0)

BYTE 3
Set to 00h

BYTE 4
Set to 01h

BYTE 5
Set to 01h

3.0 Terminology

ESCROWED – If an acceptor has taken in a token (bill or coin) and checked for validity and found that token to be genuine. An Escrow signal is sent out to report the token is in an escrowed position. Upon receiving the Escrow signal, the Master opts to send a Stack message to notify the validator to acceptor the token or a Return message to return the token.

STACKED - To indicate the acceptor has accepted a token and credit was issued accordingly. The Credit Channel Field in the uplink message will show the denomination of the token.

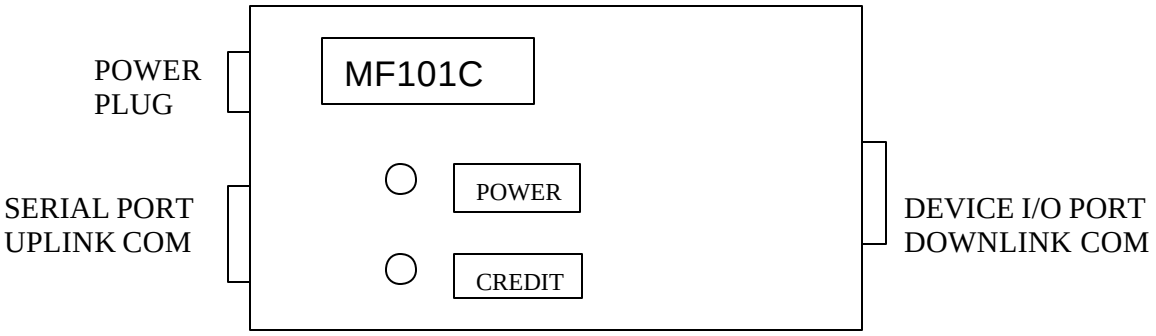
RETURNED - To indicate the acceptor has returned a token to the patron per the order of the Master.

FAILURE - This condition is reported to the Master when the MFC101 detects a failure signal (ALARM) sent from the acceptor. Conditions preventing an acceptor from taking credits include sensor failure, cashbox full, acceptor malfunction, jamming… etc. An appropriate action should be taken to resolve the acceptor problem.

POWER UP - This event indicates that the MFC101 has just experienced a power up sequence.

CREDIT CHANNEL FIELD - These three binary bits are used to show the denomination of the token that is in concern.

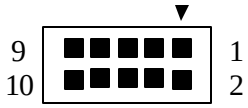
4.0 ELECTRICAL HOOKUP



SERIAL PORT – A DB9 Female connector for connection with PC COM Port.
POWER PLUG – A power supply socket receives 12 VDC 500mA.
DEVICE I/O PORT – An IDC socket for downlink connection to bill/coin acceptor.
POWER LIGHT – Green LED lights up on power up.
CREDIT LIGHT – Red LED lights up when MFC101 receives credit from the acceptor. LED goes off when all the credits have been reported to the Master.

4.1 DEVICE I/O PORT configuration

4.1.1 MFC101

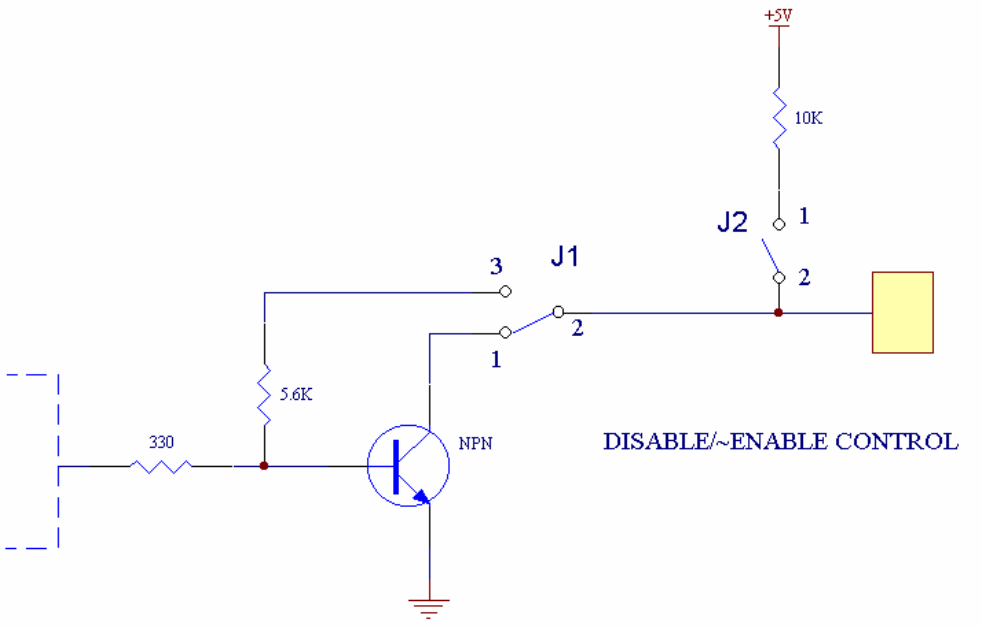


10-pin IDC socket

Pin 1	Power GND	
Pin 2	Power +12V	
Pin 3	~Credit Channel 5	(Input: Active LO)
Pin 4	Credit Channel 6 / Pulse Input	(Input: Selectable Active HI / LO)
Pin 5	ALARM	(Input: Selectable Active HI / LO)
Pin 6	DISABLE / ~ENABLE	(Output: Selectable Active HI / LO / Open Collector)
Pin 7	~Credit Channel 1	(Input: Active LO)
Pin 8	~Credit Channel 2	(Input: Active LO)
Pin 9	~Credit Channel 3	(Input: Active LO)
Pin 10	~Credit Channel 4	(Input: Active LO)

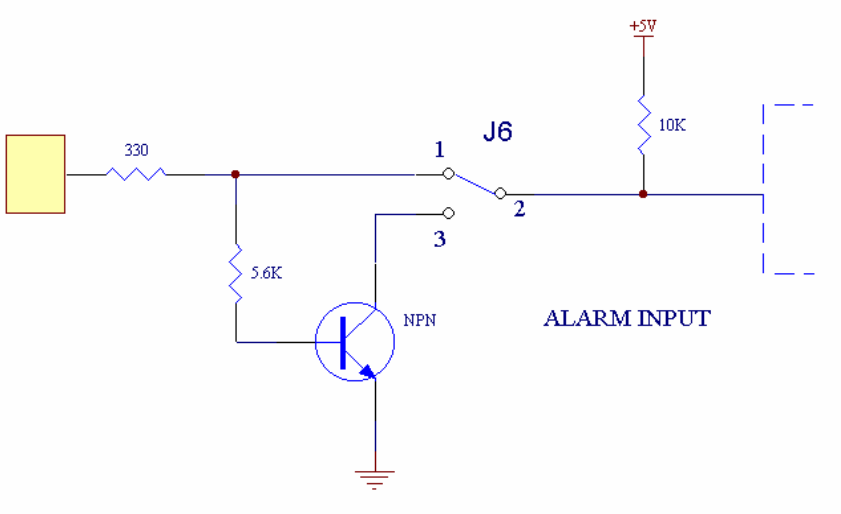
DISABLE / ~ENABLE (Output: Selectable Active HI / LO / Open Collector). Jumper: J1, J2
MFC101 set this pin to enable the acceptor, the acceptor should enter its normal operation state and set ready to accept credits. MFC101 will reset this pin to disable the acceptor on certain circumstances including:

1. Data 0 in Uplink communication is set to 00h. Disabled by Master.
2. No poll requests from the Master exceeding Lockout timer period.
3. 2 credits have been queued up in MFC101 stack pending to be released.



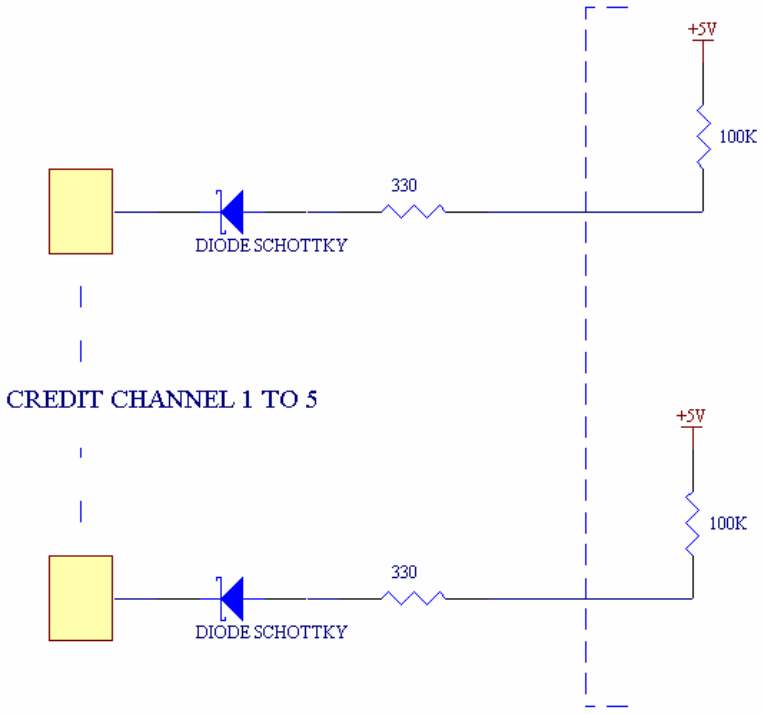
ALARM (Input: Active HI / LO). Jumper: J6

When a failure signal is given out by the acceptor due to its system failure, coil/bill jamming, or detection of cheating ... etc, this pin is brought to active. A failure message will be sent to the Host per each occurrence of the failure signal received from the acceptor.



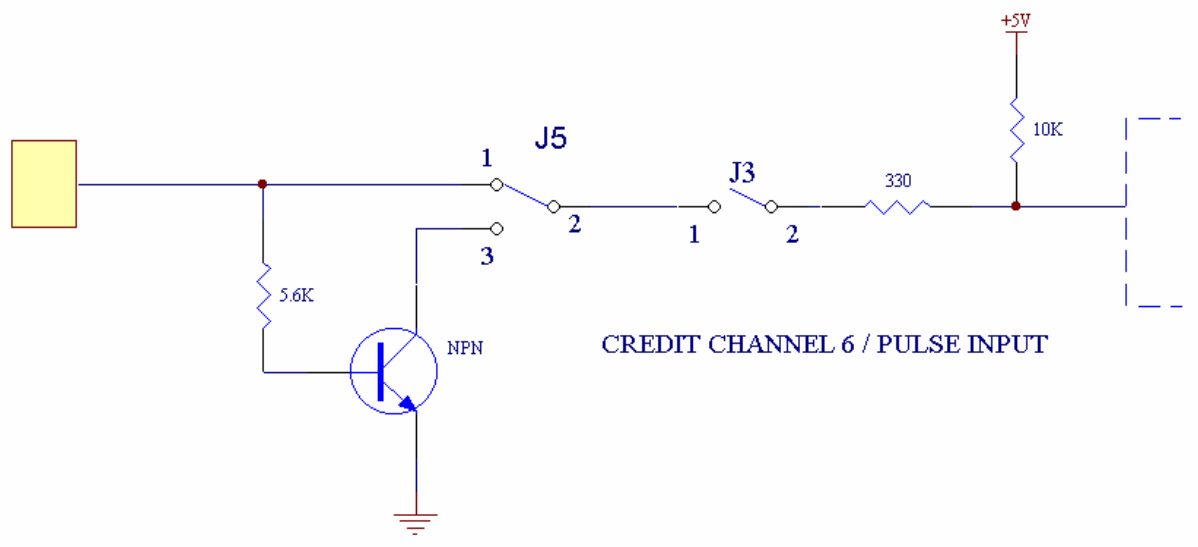
~CREDIT CHANNEL 1-5 (Input: Active Low)

5 credit report lines designated for the first 5 denominations of tokens from the acceptor. The acceptor should generate a Logic Low pulse on the denomination channel for each accepted credit. The Logic Low pulse should be within a time frame of 10msec to 200msec. An extra 10msec debounce period is added to the trailing edge (rising) of the pulse to avoid false trigger.



CREDIT CHANNEL 6 / PULSE INPUT (Selectable Active HI / LO / DISCONNECTED).
Jumper: J3, J5

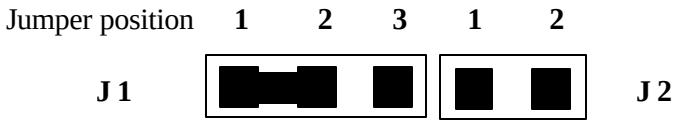
The 6th credit report line designated for the 6th denomination of token from the acceptor. This line also acts as the Pulse Input line for acceptor giving out pulse chain. The acceptor should generate a pulse within a time frame of 10msec to 200msec. An extra 10msec debounce period is added to the trailing edge (rising) of the pulse to avoid false trigger. On some acceptors, this channel also serves as an accumulative output that will give out an 'accumulative' signal upon a fulfilment of a preset credits. For instance, a one dollar credit will be given out from this channel if four individual quarters were received. In order to avoid this duplication in credits (a one dollar credit and 4 individual quarters), you may want to disconnect channel 6 for this particular purpose.



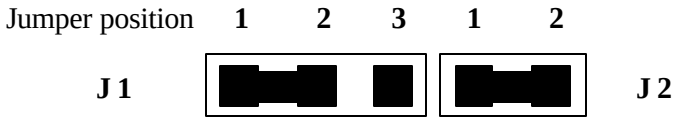
4.2.1 DEFAULT JUMPERS LOCATION (FACTORY SETTINGS)

4.2.2 DISABLE / ~ENABLE JUMPERS CONFIGURATION

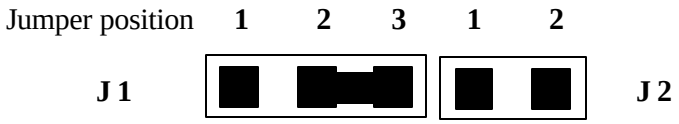
Active LO, Open Collector



Active LO, Resistor Pullup 10k



Active HI



4.2.3 LOCKOUT TIMER JUMPER CONFIGURATION

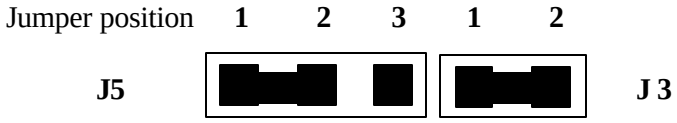
1 second

20 seconds

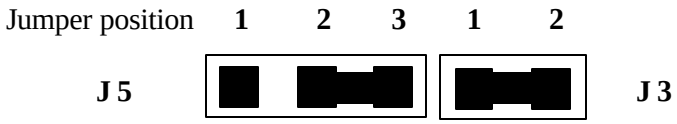
4.2.4 CREDIT CHANNEL 6 / PULSE INPUT JUMPERS CONFIGURATION

Parallel Mode

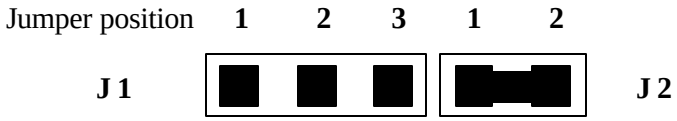
Active LO, Connected



Active HI, Connected

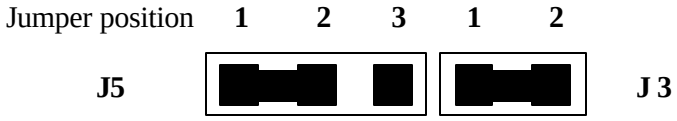


Disconnected, unused

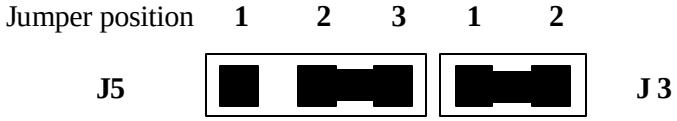


Pulse Mode

Active LO, Connected



Active HI, Connected



4.2.5 ALARM JUMPER CONFIGURATION

Active LO

Jumper position **1** **2** **3**

J 6 

Active HI

Jumper position **1** **2** **3**

J 6