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IPC-5

User Manual

Version 1.0

Document change history

Version	Date	Comments
1.0	May-26-09	First release

Disclaimer

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Hardware and electrical connections given in this manual are for illustration purposes only. Moneyflex Technologies LLC bears no responsibility of any damage or hazard that may cause.

Scope of this manual

This manual is to provide an overall view of the IPC products and IPC-5, in particular its architecture and operations. Should you find any part of the manual is missing or mistaken, please revert to us at email *tech@moneyflex.net*.

There are two more Moneyflex documents user will need before he / she can do the PC programming:

- PG001-0 Programmer's Guide
- K1 Protocol Specification

Other suggested reading material:

- NAMA MDB / ICP v3.0 Specification
- Product manual of the respective peripherals

1.0 INTRODUCTION

The Intelligent Protocol Communicator (IPC) series is a set of products designed to solve many of the connection and interface problems found in nowadays automated payment systems. No matter your money validating device utilizes an output format of a Simple Pulse, Dry relay contacts, a Parallel or Binary output, a MEI™ EBDS serial port, an ITL SSP® port, a NAMA® MDB / ICP daisy-chained bus system or the ccTalk bidirectional serial data line, IPC validates them all.

IPC consolidates all the status and events happening in your peripherals and reports them in a systematic way back to your application. It utilizes the efficient *K-1 Protocol* for communication between your application and IPC device. This unifies different communication standards found in different peripherals into one easy to learn language.

IPC makes PC based vending machine, timed internet café and POS system work like a champ. With IPC working in your system, you can take all the guess works out of your cash and cashless payment system.

1.1 IPC-5 FEATURES

- Bi-directional serial communication ports for either true RS232 (PC COM port) or TTL-232 (5V) communication
- OS independent operation
- SDKs and Drivers for software developers
- Easy to use Moneyflex developed *K1 Protocol*
- A full version of NAMA® MDB / ICP host port for advance users [open mode]
- An auto MDB host control for automatic operations [controller mode]

1.2 TERMINOLOGY

Below listed the terminologies and their explanation that are widely used in this manual.

MFX	=Short for Moneyflex Technologies LLC.
PC	=Personal computer. An IBM x86 compatible machine.
OS, OSes	=PC operation system, systems.
Device	=IPC itself or a general USB Device.
MCU, MCUs	=Micro-Processor(s) inside the device. Some devices may have multiple MCUs running together in parallel for parallel processing. A single MCU may house multiple Controllers within.
Controller	= An individual working unit that serves a particular function.
Controller ID	= An unique Address ID in Hex format that the Controller is defined to.
Peripheral	= A functional unit attaches to IPC and is controlled by an IPC Controller.
User	= User's PC application program. For better readability, this manual adopts a male user gender and uses "he" instead of "it" to represent the program.

K1 Protocol	= MFX developed computer protocol adopted by IPC and other products.
NAMA®	= The National Automatic Merchandising Association
MDB / ICP	= Multi-Drop Bus / Internal Communication Protocol communication standard developed by NAMA for use in vending and food service management industry.
MDB Host	= The MDB bus master where all the MDB commands initiate. Almost known as Vending Machine Controller (VMC).
MDB Power	= The voltage and current requirements of a MDB peripheral.
Bill Acceptor	= A device that validates paper currency (banknote) and give corresponding credits. It may have the capability to secure the banknote after validation.
Coin Charger	= A device validates coins and give corresponding credits. It may have the capability to store the coin after validation and/or dispense a particular kind of coins upon request. In IPC application, this can be a simple coin comparator or a coin acceptor/mechanism.
ms	= millisecond(s). 1/1000th of a second.
USB-IF	= Universal Serial Bus Implementer Forum. www.usb.org

2.0 ARCHITECTURE

An IPC consists of one or more CPUs working together, called the MCUs to achieve parallel processing power. Each MCU has a number of different Controllers built into it. The Controller is the working unit that user is dealing with. When user is *talking* to IPC, he is actually *talking* to an individual Controller by using the *K1 Protocol*. The protocol enables user to specify which Controller the message is directed to. Only the intended Controller with a correct ID number will reply to the request. On top of that, there is a set of global commands that all Controllers will response to.

Each Controller has its own firmware known as the kernel. The kernel version can be retrieved by user at anytime in his application. By checking the kernel version, user can know the updated information about that particular Controller.

The serial communication port provides a bi-directional serial communication connection to your host system. Its main function is to inter-connect all MCUs reside within the device and distribute user commands to/from each Controllers.

2.1 KERNEL UPGRADE

Controllers' kernel is flash ROM based. Occasionally MFX will release a new kernel version for a particular controller for newer features. This kind of upgrade can only be conducted at MFX appointed service site. Any attempt to tamper with the kernel program will lead to unit malfunction and void all warranties.

2.2 INSTALLATION

PC Installation of IPC-5 is as easy as a connection of the PC COM port to IPC-5 RS232 serial port. PC COM port **must** be configured as **19200 baud rate, 8 bit, No parity, 1 stop bit** (19200,8,n,1). In addition, IPC-5 also incorporated with a 5V TTL serial port for TTL connection.

2.3 CODE DEVELOPMENT

For complete programming details, please refer to *PG001-0 Programmer Guide*. Here are some examples of *K1 Protocol*.

- DEVICE RESET, Global command
  This command resets all Controllers, including PC Supervisor within the Device. All setup parameters will need to re-install after this command.

- ADDRESS CLASH, Global command
  This command requests all Controllers within the Device to show their existence by replying with their respective Controller ID. In order to avoid multiple Controllers sending their ID at the same time, IPC adopts a timing scheme for this. The elapse time of each Controller to send its ID is based on its ID value multiplied by 5ms time. For instance, a Controller with Controller ID 10 hex (16 dec) will reply a '10H' at 16 x 5ms, that is 80ms.

- GLOBAL SUSPEND, Global command
  This command puts most Controllers within the Device to stop their operations and enter into suspend mode. Depending on the nature of the Controller, some Controllers will turn off the attached peripheral or some will finish the current event before entering into suspend mode. Refer to the respective Controller for details.

- USER SUSPEND, Controller command
  This command puts the respective Controller into suspend condition. Depending on the nature of the Controller, some Controllers will turn off the attached peripheral or will finish with the current operation before entering into suspend mode. Refer to the respective Controller for details.

3.0 CONTROLLERS OVERVIEW

IPC-5 has the following Controller(s) built in:

[Controller ID]	[Functions]
12 (hex)	NAMA™ MDB / ICP Host

3.1 Controller 12 (hex), NAMA™ MDB / ICP HOST

MDB or ICP is a communication standard widely adopted by vending machine manufacturers for connection among bill acceptor, coin changer, card reader, etc to the host system (VMC). MDB communication employs a 11-bit serial byte format. The Mode bit being the 9th bit (MSB) of the byte dictates the direction of the message. This unique arrangement gives PC based serial ports a great challenge to handle properly. Plus the 1ms response time requirement almost throws away all non-RTOS systems.
In view of this, MFX developed this Controller to relief the above difficulties. This Controller gives user an alternative way to work with MDB system. User can access to virtually all available MDB machines in the market. There are two modes to select from the Controller:

[Controller Mode]

In Controller Mode, the following two standard peripherals are supported. Either one peripheral or both can be connected together to this host in a daisy chain manner.

Bill Acceptor; MDB Address 30H, Level 1 or higher
Coin Changer; MDB Address 08H, Level 2 or higher

This mode is ideal for user who wants to focus on his application rather than encoding and decoding the MDB communications. Minimal MDB knowledge and interaction is required. Once setup, the Controller initiates communication to the peripherals and start accessing their functions

Operation sequence:

[Controller Mode Setup]
↓
[Searching…]
↓
[Status (Setup)]
↓
[Send Enable Command]*
↓
[Poll] … repeat polling on every ~ 400ms

** After reset, Enable command data is all zero. User needs to send Enable data.*

Once the peripherals come online, the Controller automatically polls for their latest status. On each event request (Poll) sent by user, Controller replies with 8 most recent events / status happened in the peripherals together with the Event Counter. By working out the events received, user can get a complete list of actions happened in the peripherals.

[Open Mode]

In Open Mode, user has a full access to all MDB capabilities. User can program for his peripherals and do the polling system at his discretion. User can also daisy chain additional peripherals onto the MDB bus in compliance to MDB specification.

Refer to NAMA® MDB / ICP specification for programming details.

4.0 HARDWARE

Warning: NEVER HOT PLUG the device into power supply. Otherwise excessive current surge may damage both IPC and peripherals.

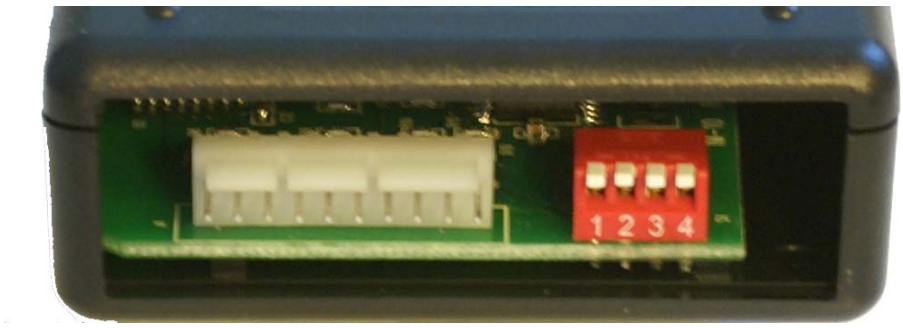
4.1 LED Patterns

IPC-5 provides 3 status LEDs for user to diagnose with his system. They are the:

[CREDIT]	Flashes when credits are detected on the acceptor. The duration of flash varies with the Poll rate.
[GAME COMMS]	Blinks when the COM port is transmitting or receiving.
[ACCEPTOR COMMS]	Flashes when MDB port is transmitting or receiving.

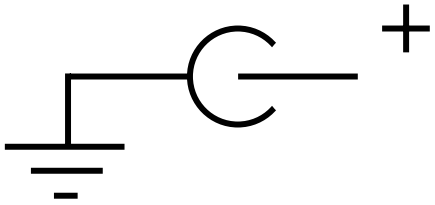
4.2 Electrical Hookups

Power port MDB Host port (ACCEPTOR)



Multi-purpose GAME port Dip switches

4.3 POWER PORT 18-34VDC

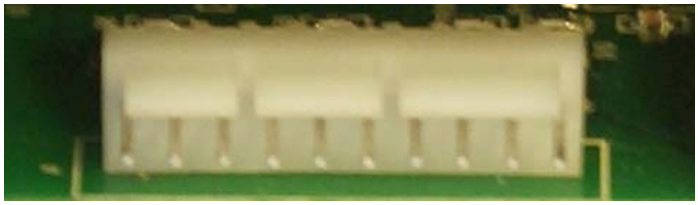


This port is a center positive power plug with a 2.1mm center pin. Connect ***REGULATED DC*** power to this port for IPC and some attached peripheral(s).

Warning: NEVER HOT PLUG the device into power supply. Otherwise excessive current surge may damage both IPC and peripherals.

MDB peripherals usually work between 18VDC to 34VDC. Refer to their respective user manual for correct voltage setup. When more than one MDB peripherals are connected together in a daisy chain manner, the total power requirement equals the sum of the maximum power (Amp) drawn by all active peripherals at their peak power. Be sure to provide with enough current (Amp).

4.4 GAME PORT



Pin 1 Pin 10

PIN #	FUNCTION	TYPE	CONNECTION TO
PIN 1		n/a	Not used
PIN 2	PWR GND	Power	Not used
PIN 3	TTL 232	TXD	TTL 232 RXD
PIN 4	TTL 232	RXD	TTL 232 TXD
PIN 5	Signal GND	Power	COM GND
PIN 6	GPIO	Output	Not used
PIN 7	RS 232	TXD	RS 232 RXD
PIN 8	RS 232	RXD	RS 232 TXD
PIN 9	GPIO	Input	Not used
PIN 10	GPIO	Input	Not used

Warning: NEVER connects both pairs of RS232 TXD/RXD and TTL232 TXD/RXD simultaneously. Violation of this will result in unexpected operation or damage of device.

4.5 MDB PORT

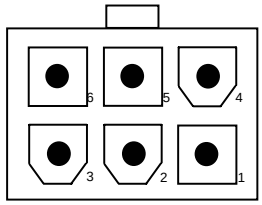
Molex P/N: 39-30-1060; Mated with Molex P/N: 39-01-2060 or AMP P/N: 106527-6

Note: Refers to POWER PORT section for MDB Power connection

The MDB bus (wire) consists of power lines and signal lines. Power is supplied from Host to peripherals. Voltage ranges from 18VDC to 34VDC. In some unregulated host system, it may reach as high as 42V. Signal lines consist of Transmit (TXD), Receive (RXD) and Signal GND.

Connector Pin-out:

Line 1 – Power VDC
Line 2 - DC Power Return
Line 3 - N/C
Line 4 - Master Receive
Line 5 - Master Transmit
Line 6 - Communications Common



Looking toward connector

4.6 DIP SWITCHES

All Dip switches are reserved for future usage.

Electrostatic Discharge Precaution:
The normal function of the device may be disrupted by a strong electromagnetic interference. If so, simply reset the device by cycling the power. Normal operation should be resumed. If in such a case that the function could not be resumed, relocate the device to another ESD-safe location.