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Phyton™

CPI2-B1 In-System Device Programmer

User's Guide

Member of ChipProg-ISP2 family

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CPI2-B1 In-System Device Programmer

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1 Introduction

Phyton™

CPI2-B1
In-System Device Programmers

User's Guide

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1.1 Terminology

Terms used in the document

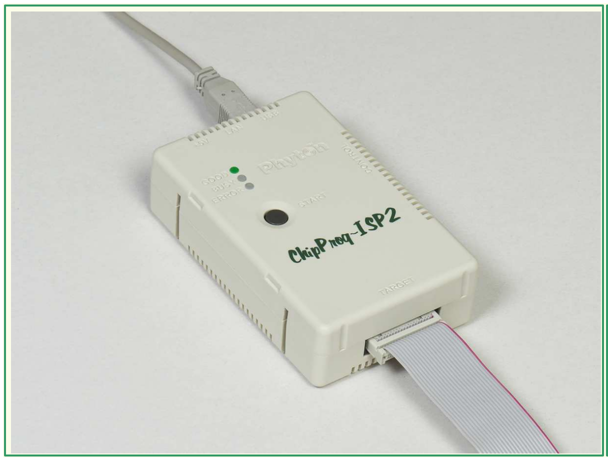
ISP or **in-system programming**	Operations on device mounted on a board in user equipment. ICP is performed via a cable connecting programmer to the target either directly or via needles or pogo contacts.
ICP or **in-circuit programming**	Same as ISP above.
	Mode of the in-system programming that is usually defined by the programming signals voltage or the ISP interface (JTAG, SWD, UART, SPI, etc.). Distinct ISP modes are enabled for different target devices and more than one mode may exist for one device.
Target device or **Target**	A serial flash memory device, microcontroller or programmable logical device having memory inside which can be programmed by an in-system device programmer. In CPI2-B1 GUI device names comprised of part numbers (full or reduced) following types of ISP programming modes in [ ] brackets (for example: PIC10F200 [ISP HV Mode], M25PX80 [ISP Mode]).
DUT	Device Under Test - same as target device above.
Start and **End Addresses** (of the Target device)	Physical memory range of target device to perform programming operations (read, write, verify, etc.) on.
Programming Interface	On-device port that enables access to the internal memory that includes but not limited to: SPI, I2C, JTAG, SWD, UART.
ISP Mode	Mode of the in-system programming. Distinct ISP modes are enabled for

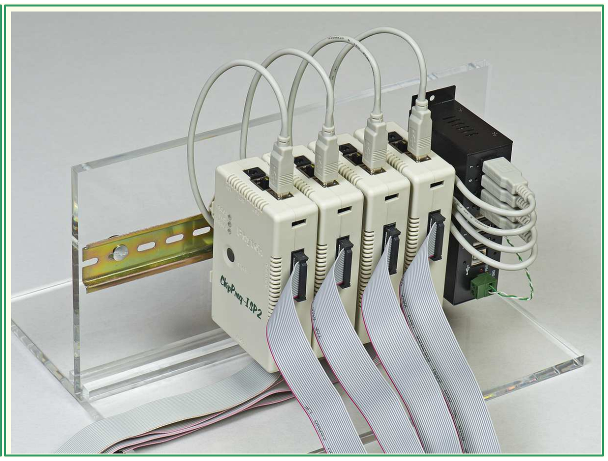
	different target devices and more than one mode may exist for one device.
ISP JTAG Mode	In-system programming using JTAG interface.
ISP SWD Mode	In-system programming using SWD (single wire debug) interface.
ISP EzPort Mode	In-system programming using Freescale proprietary EzPort interface.
ISP HV Mode	In-system programming that requires application of relatively high voltage to the target device (12V for example).
File	In the CPI2-B1 context the term **file** may represent: a) an image of information on a PC hard drive or other media that is supposed to be written into the target device's physical memory, or b) an image fetched from the target device and stored on the disk or other media. Files in ChipProg can be read from and writted to a PC hard drive or CD.
Buffer or **Memory buffer**	Buffers are intermediate data holders between data in files and data in the target device. A buffer is a portion of computer memory (RAM) used to temporarily store, edit and display data to be written to the target device or read from the device. User can open any number of buffers of any size only limited by available computer memory.
Buffer layer or **sub-layer**	A buffer may hold several layers (also known as sub-layers) that according to architecture and memory model of a particular target device. For example, for some microcontrollers one buffer can include the code and data memory layers (see more details below).
Buffer size	Buffers size may vary from 128KB to 32GB.
Buffer start address	The address to display the buffer contents from.
Checksum	An arithmetic sum of all bytes of data in a specified part of buffer calculated by programmer to ensure data integrity. The program has a variety of algorithms for checksum calculation and allows writing the checksum into a specified location of the target device.
Command Line mode	Method of controlling a CPI2-B1 in which the user issues commands to the computer program in the form of successive lines of text (command lines).
Standalone Operation Mode	CPI2-B1 device programmer contains internal memory card that can hold all information that the device programmer needs to run without further interaction with a PC.
Project	An integrated set of information that completely describes the target device, properties of data buffers, programming options and settings, list of source and destination files with their properties, etc. Each project with a unique name can be stored and promptly reloaded for immediate execution. Usually user creates a project to work with one type of device. Using projects saves a lot of time during initial configuration of programmer every time you start working with a new device.

1.2 CPI2-B1 device programmer

ChipProg-ISP2 is a family of in-system device programmers produced by Phyton, Inc. Microsystems and Development Tools. This family currently represented by two models: a single-channel CPI2-B1 and CPI2-Gx gang device programmer.

CPI2-B1 device programmers are primarily intended for use in test fixtures for programming single boards and multi-board panels. For this purpose multiple CPI2-B1 units can be driven from one computer in the gang mode. This device programmer can be also used for engineering and field service. The programmer works under control of the ChipProg-02 software package. See a single CPI2-B1 and four CPI2-B1 units mounted on a rail on the pictures below.





1.2.1 Features Overview

Features Overview

- Programs devices with Vcc from 1.2V to 5.5V.
- Supports JTAG, SWD, SPI, SCI, I²C, UART, and other interfaces.
- Extremely fast.
- Can program some devices at a long distance of up to 5m (~15ft).
- Up to 72x CPI2-B1 units can be controlled by a single computer.
- Each of ganged programmers works independently.
- USB 2.0 High Speed and LAN 100 Mbit/s communication interfaces.
- Opto-isolated RS-232 interface (optional).
- ATE interface for stand-alone operations.
- Each module has memory card that enables stand-alone operations.
- Friendly intuitive graphical user interface (GUI).

- Simplified graphical user interface for use by unskilled personnel.
- Application Control Interface (ACI) provided by a DLL.
- ACI enables control from programs in Visual Basic, C, C++, C#, etc.
- ACI enables control from National Instrument® LabVIEW™.
- On-the-fly utility allows controlling already launched programmer.
- Software includes scripting language.
- Project files are protected against hackers and corruption.
- Programmer kit includes a bracket for mounting on a standard DIN rail.
- Clip-on compartment for a battery, LEDs and a button for standalone operations (optional).

1.2.2 Hardware characteristics

NOTE. Some of the features and items below may be unavailable by the moment of sale of your CPI2-B1 device programmer

Housing Options and Applications
- Palm-size unit in a plastic enclosure.
- User-configurable gang programming system comprised of single CPI2-B1 units mounted on a standard DIN rail
- Hand-held battery-powered tool for in-field service.

Extra Options and Ordering Codes
- CPI2-B1 – single-channel programmer with no galvanic isolation of control lines.
- CPI2-ISO – single-channel programmer with galvanic isolation of control lines and RS-232 interface.
- CPI2-BB – add-on compartment with Li-Ion battery and controls for stand-alone operation.
- All above options include plastic brackets for mounting programmer units on a standard EN 50022 (TS35) 35 mm DIN rail.

Communication interfaces
- USB 2.0 High-speed.
- 100 Mbit/s Ethernet (LAN).
- RS-232C (with CPI2-ISO option only).

Powering the programmer
- From external power supply 5V/1A (not included).
- From PC USB port.
- Rechargeable Li-Ion battery (with CPI2-BB option only).

Powering Targets from the Programmer
- When powered from an external power supply (5V@1A), provides the target equipment with the voltages: Vcc (1.2 to 5.5V @ up to 350mA) and Vpp (1.2 to 15V @ up to 80mA).

Signals to/from the Target
- Ten input/output lines with logical levels 1.2 to 5.5V that can be individually programmed as TTL/ CMOS logic I/O.
- The signal lines above alternate with GND lines for stable programming via long cables.
- Two input/output lines which can be individually programmed as TTL logic I/Os, GNDs, Vcc or Vpp.

Control Methods
- Start/Stop logic signal for external control.
- Output signals for external control: BUSY, GOOD and ERROR.
- Six logic inputs for choosing one of 64 preloaded projects.
- One low-current output for setting that can be used for project selection code.

- One output signal for charging an add-on battery (CPI2-BB).
- Three GND lines.

Dimensions
- CPI2-B1 unit: 114 x 73 x 32 mm (~4.5 x 2.9 x 1.25 inch).
- With CPI2-BB battery: 114 x 99 x 32 mm (~4.5 x 3.9 x 1.25 inch).

1.2.3 Software features

NOTE. Some of the features and items below may be unavailable by the moment of sale of your CPI2-B1 device programmer.

System Requirements
- Microsoft® Windows™ 7, 8 or 10.

Software Features
- Supports loading and saving files in all popular formats.
- Unlimited number of data buffers can be open and maintained.
- Enables arithmetic operations with data blocks in buffers.
- Enables writing serial numbers, MAC addresses and other device-specific parameters into user-selectable shadow areas of target devices.
- Allows writing of user-defined signatures and data blocks into target devices.
- Offers several algorithms for calculating checksums.
- Special DLL for user-defined checksum calculation.
- Writes programming session logs with real time stamps.
- The GUI has a special editor for easy setting of device and algorithm parameters, such as fuses, lock bits, boot loader vectors, etc.
- Comprehensive self-test procedure.

Managing Projects and Configurations
- The software supports unlimited number of projects.
- Project files are protected against hackers and corruption.
- The software ensures data integrity - every data transfer to/from a PC or ATE system or memory card is accompanied with CRC sum.
- The software allows storing and retrieving the state of user interface: configurations, colors, fonts, hot keys and other settable preferences.
- Battery powered option allows storing 4 projects on internal memory card; user-selectable by pressing the button on battery compartment.

Computer Control Methods
- From Automated Test Equipment (ATE), In-Circuit Test System (ICT), or programming fixtures.
- From command line or via Application Control Interface (DLL).
- Integration with National Instruments® LabVIEW™ software.
- On-the-fly management utility allows control of already launched and running device programmer.
- Built-in scripting language for writing user scripts. Auto programming can be started by closing fixture lid or by connecting a device.
- Friendly and intuitive graphical user interface (GUI) for creating and debugging projects.
- Optional simplified user interface for unskilled personnel.

Standalone Control
- The programmer can work in a standalone mode that does not require connection to a computer.
- Up to 255 standalone projects can be stored on a built-in memory card.

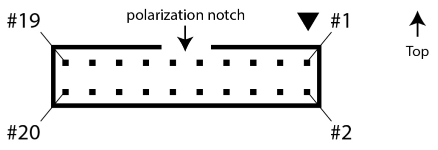
- Any project can be launched by ATE signals or from a computer.
- Special utility allows monitoring standalone activity on a computer.

1.2.4 Connector TARGET

TARGET connector

The **TARGET** connector positioned on the front panel enables connecting a CPI2-B1 device programmer to the target device by the 20-wire ribbon cable included in a CPI2-B1 kit. See here the connector pin assignment and description of the signals in the matrix below.

CPI2-B1 TARGET connector



Pin#	Signal	Signal description – all signals are bidirectional
1	P1	Log 0/1, Vcc or GND
2	P11	Log 0/1, Vcc, Vpp or GND
3	P2	Log 0/1, Vcc or GND
4	GND	Ground
5	P3	Log 0/1, Vcc or GND
6	GND	Ground
7	P4	Log 0/1, Vcc or GND
8	GND	Ground
9	P5	Log 0/1, Vcc or GND
10	GND	Ground
11	P6	Log 0/1, Vcc or GND
12	GND	Ground
13	P7	Log 0/1, Vcc or GND
14	GND	Ground
15	P8	Log 0/1, Vcc or GND
16	GND	Ground
17	P9	Log 0/1, Vcc or GND
18	GND	Ground
19	P10	Log 0/1, Vcc or GND
20	P12	Log 0/1, Vcc, Vpp or GND

- P1 to P10 - logical signals formed by high-speed buffers that can output target-specific logic 0 or 1, Vcc or GND levels, according to the chosen target device type. These lines can output Vcc with levels from 1.2 to 5.5V @ up to 350mA. The buffers are bidirectional, also serving as inputs when the CPI2-B1 programmer reads data.

- P11, P12 – signals formed by high speed mixed-signal circuits that can also output target-specific logic 0 or 1, Vcc or GND levels according to the type of the chosen target device. These lines can output Vcc with levels from 1.2 to 5.5V @ up to 350mA. The mixed-signal buffers are bidirectional, also serving as inputs when the CPI2-B1 programmer reads data. In addition, these two signals can output Vpp voltage with levels from 1.5V to 15V @ up to 100mA.

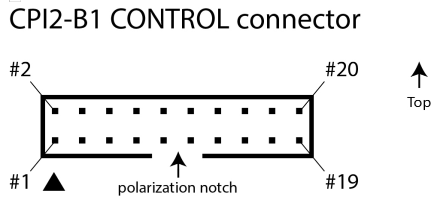
The P1…P12 signals are target-specific. A CPI2-B1 user must ensure that the target device (DUT) is properly connected, according to the target-specific wiring diagram published on the http://phyton.com/products/isp/chipprog-isp2-family/cpi2-b1-connecting web page. When programmer is controlled by the GUI, the same diagram can be viewed in a browser by clicking the **Connection to the target device** link in the **Device Information** window.

To "cut off" the target in the stand-by mode or after completion of any programming operation, CPI2-B1 programmer leaves the P1…P12 signals in high impedance state.

1.2.5 Connector CONTROL

CONTROL connector

The **CONTROL** connector positioned on the right side of the CPI2-B1 unit enables connecting the programmer to Automated Test Equipment (ATE) or the fixture by the 20-wire ribbon cable. See here the connector pin assignment and description of the signals in the matrix below. Since the programmer can be optionally equipped with a CPI2-ISO IO galvanic isolation board with RS232 interface, there are two different diagrams shown below.



Variant WITHOUT optical isolation (CPI2-ISO is NOT installed inside of CPI2-B1)			
Pin#	**Signal**	**Type of signal**	**Signal description – all signals are bidirectional**
1	GND	Ground	Ground
2	GND	Ground	Ground
3	PROJ_SEL0	< Input	Project select 0; active log 1
4	START	< Input	Control signal that launches/stops programming; active: log 0
5	PROJ_SEL1	< Input	Project select 1; active: log 1
6	5V_CHARGE	Output >	5V @ 500 mA sending to battery compartment for charging the

			battery
7	PROJ_SEL2	< Input	Project select 2; active: log 1
8	5V_IN	< Input	5V input - either from external power supply or the CPI2-B1 battery
9	PROJ_SEL3	< Input	Project select 3; active: log 1
10	5V_IN	< Input	5V input - either from external power supply or the CPI2-B1 battery
11	PROJ_SEL4	< Input	Project select 4; active: log 1
12	GND	Ground	Ground
13	SAMODE	< Input	Standalone mode control; active: log 1
14	GND	Ground	Ground
15	ST_GOOD	Output >	Signal GOOD sent to ATE; active: log 0
16	GND	Ground	Ground
17	ST_BUSY	Output >	Signal BUSY sent to ATE; active: log 0
18	NC	Not connected	Not connected
19	ST_ERROR	Output >	Signal ERROR sent to ATE; active: log 0
20	NC	Not connected	Not connected

- **PROJ_SEL[4..0]** – 5-bit selector for choosing one of 32 preloaded projects - the #0 project select code is 000000, the #4 project - 000100;
- **ST_GOOD | ST_ERROR | ST_BUSY** - programmer status lines; active status: log 0;
- **START** - External signal launching and stopping the programmer; active status: log 0. If this signal remains applied to this connector pin for longer than 2 sec it switches the programmer to the Standalone Mode;
- **5V_CHARGE -** +5V @ 500mA max signal that charges CPI2-BB battery. It can be used for powering on the project selector;
- **5V_IN** – 5V supplied either from an external power adapter plugged to the programmer or from a stacked CPI2-BB compartment with a built-in battery or floating 0V if both external power adapter and CPI2-BB compartment are not connected to the CPI2-B1 unit.
- **SAMODE** - Standalone mode control; log 1 applied to this input at a moment of powering the programmer on switches the programmer to the standalone mode.

Variant WITH optical isolation (CPI2-ISO is installed inside of CPI2-B1)			
Pin#	**Signal**	**Type of signal**	**Signal description – all signals are bidirectional**
1	NC	Not connected	Not connected
2	NC	Not connected	Not connected
3	PROJ_SEL0	< Input	Optically isolated project select 0; active log 1
4	START	< Input	Optically isolated control signal that launches/stops programming; active: log 0

5	PROJ_SEL1	< Input	Optically isolated project select 1; active: log 1
6	V_ISO	Output >	Optically isolated 5V @ 10 mA max
7	PROJ_SEL2	< Input	Optically isolated project select 2; active: log 1
8	NC	Not connected	Not connected
9	PROJ_SEL3	< Input	Optically isolated project select 3; active: log 1
10	NC	Not connected	Not connected
11	PROJ_SEL4	< Input	Optically isolated project select 4; active: log 1
12	GND	Ground	Optically isolated GND line
13	SAMODE	< Input	Standalone mode control; active: log 1
14	GND_ISO	Ground	Optically isolated GND line
15	ST_GOOD	Output >	Optically isolated signal GOOD sent to ATE; active: log 0
16	GND_ISO	Ground	Optically isolated GND line
17	ST_BUSY	Output >	Optically isolated signal BUSY sent to ATE; active: log 0
18	RS232_TX	Output >	Data transmitted to computer
19	ST_ERROR	Output >	Optically isolated signal ERROR sent to ATE; active: log 0
20	RS232_RX	< Input	Not connected

- **PROJ_SEL[4..0]** – 5-bit selector for choosing one of 32 preloaded projects - the #0 project select code is 000000, the #4 project - 000100;
- **ST_GOOD | ST_ERROR | ST_BUSY** - Optically isolated programmer status lines; active status: log 0;
- **START** - Optically isolated external signal launching and stopping the programmer; active status: log 0; If this signal remains applied to this connector pin for longer than 2 sec it switches the programmer to the Standalone Mode;
- **5V_CHARGE** +5V @ 500mA max signal that charges CPI2-BB battery. It can be used as a power source for the project selector;
- **5V_IN** – 5V supplied either from an external power adapter plugged to the programmer or from a stacked CPI2-BB compartment with a built-in battery or floating 0V if both external power adapter and CPI2-BB compartment are not connected to the CPI2-B1 unit.
- **SAMODE** - Standalone mode control; log 1 applied to this input at a moment of powering the programmer on switches the programmer to the standalone mode.

1.2.6 Single- and Gang-programming control modes

ChipProg-02 software allows to drive CPI2-B1 device programmers in two different modes:

- **Single-programming** mode for programming one target device at a time by means of one CPI2-B1 programmer.

- **Gang-programming** mode for simultaneous programming of multiple devices by means of multiple CPI2-B1 programmers driven from one PC. This mode is intended for mass production in test fixtures or other ATE.

The programming mode is set in the **Startup** dialog by checking and unchecking the **Gang Mode** checkbox.