PRELIMINARY VERSION

ICC-1C Industrial Current Controller – 1 Channel

Main features:

- Industrial controller with robust casing and DIN rail adapter
- 1 channel for driving Optotune tunable lens (current up to +/-500 mA)
- Communication interfaces:
  - USB, I2C, UART, Ethernet with PoE+ capability
  - Analog input (0 – 10 V)
  - Trigger IN/OUT
- Graphical user interface *Optotune Cockpit* for control via USB, UART[1] or Ethernet
- Software SDKs for Python and C# available
- RoHS, REACH and CE certified

Mechanical specifications

Dimensions (L x W x H)	64 x 105 x 28.7	mm
Weight	240	g
USB connector	USB-C	-
Max. USB cable length[2]	2	m
Max. lens cable length (Hirose)[3]	5	m
Accepted DC Barrel Plug	2.1 I.D. x 5.5 O.D. x 10.0	mm
Output connector	Hirose HR10G-7R-6SB(73)	
Auxiliary output connector	Standard rectangular header, 100” (2.54mm) pitch	10 pins
I/O connector	Standard rectangular header, 100” (2.54mm) pitch	14 pins
Mounting	T-slots for standard M4 nut	

Electrical specifications

Supply voltage range	5 to 48 (±5%)	VDC
PoE specification	PoE+ 803.3at	
Total power consumption (max)	15	W

Thermal specifications

Operating temperature	0 to 40	°C
Storage temperature	-40 to 85	°C

Driver outputs

Maximum current	±500	mA
Minimum current step	65	µA
Resolution	14	bits
Front-end voltage[4] (configurable)	6 – 15 (factory default = 12)	V
Output voltage limit	6 – 15	V

[1] Cockpit software supports UART which is available on I/O connector. Compatible CP210X USB to UART Bridge must be used.
[2] Maximum tested cable length in lab conditions, actual performance may depend on electromagnetic environment. Longer lengths are possible using active USB cables.
[3] Maximum tested cable length in lab conditions. Maximum cable length may depend on electromagnetic environment.
[4] The front-end voltage supplies the output stage. The output voltage is slightly lower than the front-end voltage.

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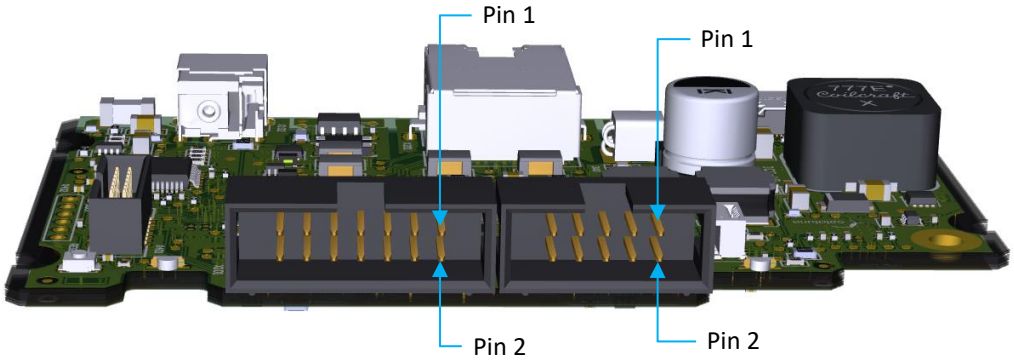
Output stage topology	Full bridge, filtered PWM (load not grounded)	
Digital communication with lens	Dedicated I2C bus, 400kHz max.	
I2C logic level (pullups implemented)	3.3	V
Power for I2C (each channel separately)	3.3	V
Power for logics, max. current	typ. 100	mA
Status LED (main + each channel)	Red, Green, Orange LED	

Driver inputs

Analog inputs level (4 channels)	0 – 10	V
Analog input resolution (each channel)	16	Bits
Analog input BW	10	kHz
Digital inputs	GPIO, I2C, UART	
Digital inputs logic level	3.3 (**NOT** 5 V tolerant)	V

Input/Output connector pinout



I/O 14-pin connector pinout		
Position	**Function**	**Description**
1	External VCC Enable	Enable signal for external power supply (connect to Power GND to activate)
2	AnalogIn	Analog Input for Y axis
3	Signal GND	Digital and analog ground
4	Signal GND	Digital and analog ground
5	UART TX/ I2C SCL	Serial interface transmitter line / I2C clock line[1]
6	GPIO1	General purpose digital IO #1, Trigger Input/Output[2]
7	UART RX/ I2C SDA	Serial interface receiver line / I2C data line[1]
8	GPIO0	General purpose digital IO #0, Trigger Input/Output[2]
9	-	Reserved
10	-	Reserved
11	-	Reserved
12	-	Reserved
13	External VCC	External power supply input[2]
14	External GND	External power supply input - ground
		[1] *configurable external serial interface UART or I2C*
		[2] *configurable input/output*

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Lens 10-pin connector pinout		
Position	**Function**	**Description**
1	NC	Not connected
2	NC	Not connected
3	VCC for logic	3.3 V
4	I2C SDA	Digital signal
5	GND for logic	Digital ground
6	I2C SCL	Digital signal
7	Device Detect	Lens connected detection signal
8	nWrite CTRL	Lens EEPROM Write control signal
9	Lens (+ pole)	Lens current control – positive polarity
10	Lens (- pole)	Lens current control – negative polarity

Main status and Channel status LEDs

LED	Color	Legend
Main Status	Red	Power on, no connection
	Orange	Operation OK (possible error)
	Green	Operation OK
Channel Status	Red	Device error
	Green	Device detected; operation OK

Control via analog input

The ICC-1C can be controlled via a dedicated 0-10 V analog input. The resolution of the ADC is 16 bits. The analog input can be mapped to Current or Focal power (if applicable) of the connected lens. Both linear and non-linear mapping are possible.

For additional information on how to set up the analog mapping, please refer to the Optotune Cockpit software manual.

Waveforms with output or input trigger

The ICC-1C has a build in signal generator, which can be configured for different types of waveforms:

- Sine
- Rectangle
- Triangle
- Sawtooth
- Pulse
- Steps
- Any custom vector

By default, the controller outputs a trigger signal on the GPIO pin. The trigger signal is HIGH (3.3V, max. 5 mA) at phase 0° of the selected waveform and goes LOW in the middle of the period. For pulse pattern, it reflects the duty cycle.

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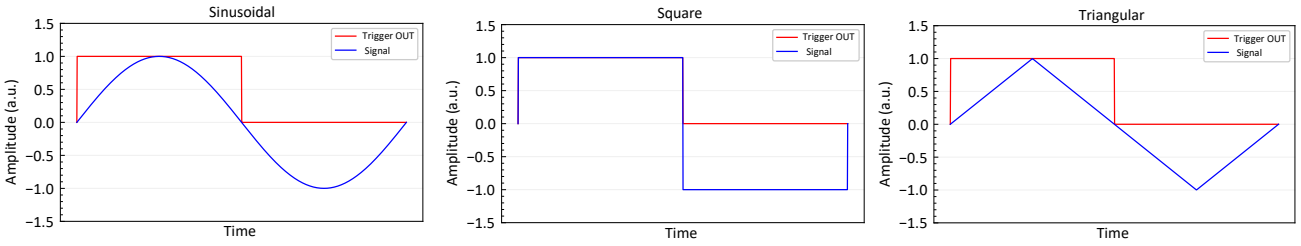

Figure 1: Different waveforms overlapped with the corresponding Trigger OUT signal.

The signal generator can also be synchronized with an external input trigger. When the trigger input signal goes HIGH (max 3.3V), the selected waveform starts off at phase 0°.

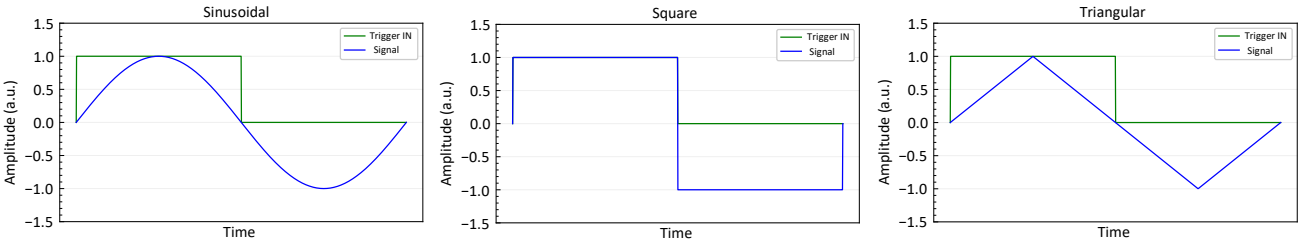

Figure 2: Different waveforms overlapped with an exemplary Trigger IN signal.

Simple mode communication

Simple mode communication is RS-232 based serial communication interface that can be used to communicate to the device via a Serial Terminal (e.g., *Termite*, *Putty.* Baud rate: 256000, Parity: N, Stop bits: 1, Data bits: 8) or via *Telnet Client* (on Windows OS), if Ethernet communication is used. It employs a set of ASCII characters commands and answers to interact with ICC-1C driver features. Commands and replies are terminated by character sequence CR, LF (resp. 0x0D, 0x0A). The protocol is not case sensitive and white spaces are ignored.

List of simple mode replies:

Simple communication mode reply	Description
OK[CR][LF]	Command accepted and performed without limits.
NO[CR][LF]	Command not accepted, for any reason.
OL[CR][LF]	Command not accepted, because parameter reached lower limit.
OU[CR][LF]	Command not accepted, because parameter reached upper limit.
ERROR[CR][LF]	Command not available.

List of simple mode commands:

Simple mode command	Description
START[CR][LF]	Answers “OK” if controller is ready to use and device is detected. Otherwise “ERROR” is received.
STATUS[CR][LF]	Controller answers with status encoded within 4 Bytes information. Example: “0x00015000[CR][LF]”. See next section for further description of the status bytes.
ACKNOWLEDGE[CR][LF]	Clears history error flags in the status register. Answers “OK”.
RESET[CR][LF]	Restarts controller’s firmware. Note: no answer is sent via serial line
GOTODFU[CR][LF]	Starts controller’s loader for firmware update. Note: no answer is sent via serial line
GOPRO[CR][LF]	Starts binary protocol-based mode of serial communication. Serial message CRC is not checked.
GOPROCRC[CR][LF]	Starts binary protocol-based mode of serial communication. Serial message CRC is checked.

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GETID[CR][LF]	Answers with firmware serial number. Example: “14352500-00-A[CR][LF]”.
GETVERSION[CR][LF]	Answers with firmware version number. Example: “1.0.740706[CR][LF]”.
GETGITSHA1	Answers with 40 bytes hexadecimal GIT build identification. Example : “eb8115e6b04814f0c37146bbe3dbc35f3e8992e0[CR][LF]”
GETSN[CR][LF]	Answers with board and device serial number. Example: “Board: CDAA0057, Device: ANAA1234[CR][LF]”.
DETECTDEVICE[CR][LF]	Runs autodetection of device on active channel, answers with device name. Example: “EL-16-40-TC[CR][LF]”.
GETDEVICESN[CR][LF]	Answers with serial number of a device connected. Example: “Device: ANAA1234[CR][LF]”
SETCURRENT=%float[CR][LF]	Sets current value. Command supports decimal parameter value in mA units. Current value is limited either by power capabilities of ICC-1C controller itself or connected device.
GETCURRENT[CR][LF]	Answers with value of active current. Returned value is decimal number in units of milliamperes, Example: “15.6[CR][LF]”
SETFP=%float[CR][LF]	Sets focal power. Supports float value in units of diopters limited to detected lens device capability.
GETFP[CR][LF]	Answers with focal power. Returned value is a float in diopters. If no lens is detected, it returns “NO”.
GETFPMIN[CR][LF]	Answers with focal power lower limit of lens device connected. Returned focal power is decimal value in diopters. If no lens is detected, it returns “NO”.
GETFPMAX[CR][LF]	Answers with focal power upper limit of lens device connected. Returned focal power is a decimal value in diopters. If no lens is detected, it returns “NO”.
GETTEMP[CR][LF]	Answers with actual temperature of device connected. Returned temperature is a decimal value in units of degree Celsius. Example : ”27.54[CR][LF]”.
SETTEMPLIM=%f[CR][LF]	Sets operational temperature limit in degree Celsius.

Pro mode communication protocol

Pro Mode communication protocol with additional functionalities is available on request.

Safety and compliance

The product fulfils the RoHS, REACH and CE compliance standards. The customer is solely responsible for complying with all relevant safety regulations for integration and operation.

For more information on optical, mechanical, and electrical parameters, please contact sales@optotune.com.

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