OPTIC4 090311 User Guide

Updated 6/7/12

Overview

The OPTIC4 allows MPU11 based control systems to interface to third party servo drives that accept -10 to +10 VDC current or velocity requests. OPTIC4 may also be specially configured for legacy DC protocol compatibility to emulate the OPTIC1 board.

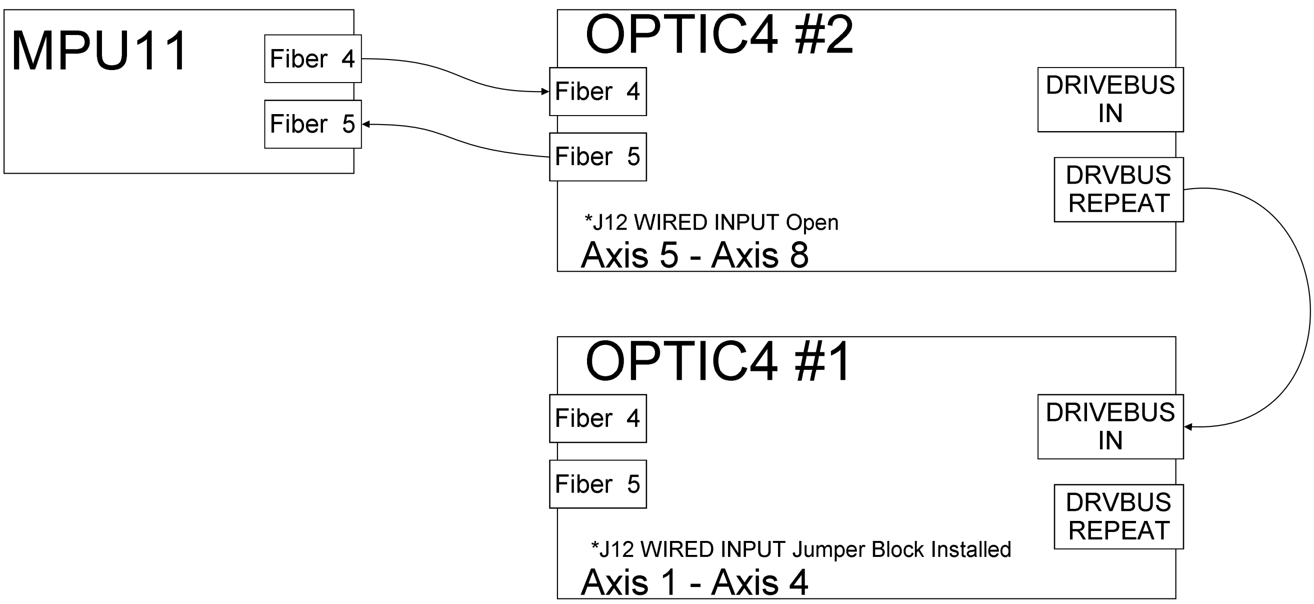
OPTIC4 Features

Application:	Third Party Drive Interface
Number of Axes:	4
Maximum number of Axes:	8 with two OPTIC4 cards in series
DAC resolution:	16 bits
Analog Output Voltage:	-10 to +10 Volts
Control Interface:	2 fiber optics to MPU11 motion control card
Dimensions (W*D*H):	12 * 5 * 0.75 inches

OPTIC4 Connection Overview

Two OPTIC4 interface cards can be connected to a MPU11 motion control card. The OPTIC4s will negotiate their axis numbers based on the order they are connected. The last OPTIC4 in the communication chain will initiate communication and start numbering axes at 1. LED1 will flash one segment at a time during startup while the OPTIC4s determine their location in the communication chain. After about 10 seconds the OPTIC4 for axes 1 - 4 will indicate 1 on LED1, and the OPTIC4 for axes 5 - 8 will show 5 on LED1. Once LED1 stops blinking, startup negotiation is complete and normal operation begins.

LED1 normally indicates the base, or first, axis number on the OPTIC4. If the decimal point is lit, and a number is flashing on LED1, this indicates an error condition that can be found in the "LED1 Error Codes" section.



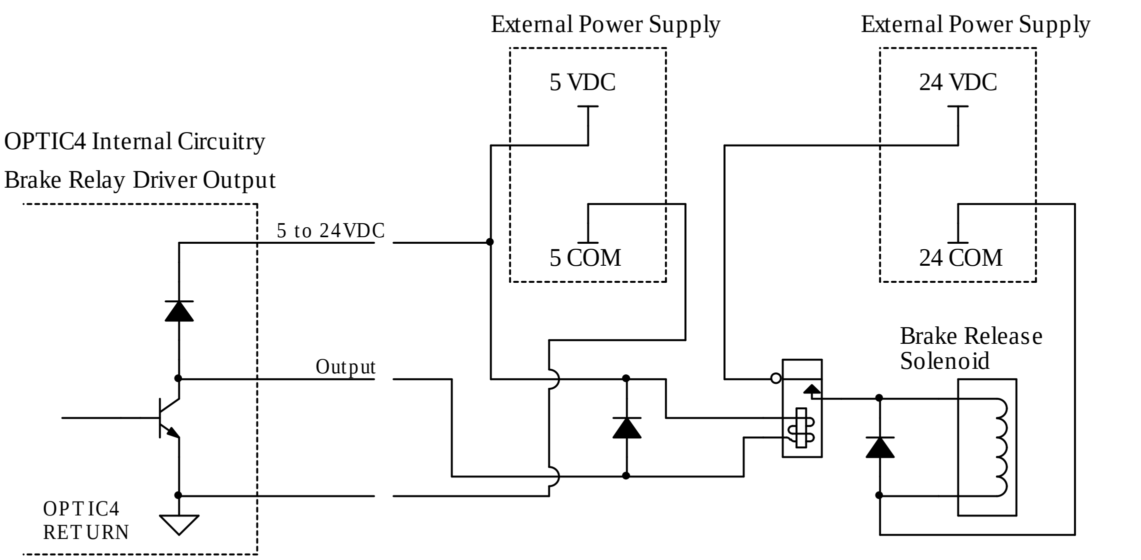
Jumper Functions

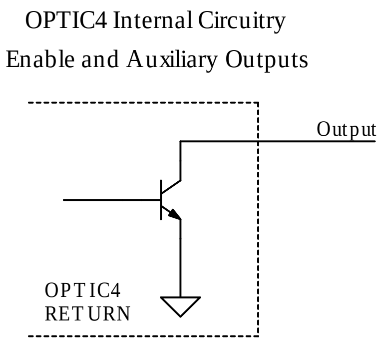
Designator	Jumper Name	Function with jumper block in place	Function with jumper block removed
J13	Enable Active High	Enable outputs will pull down when axis is released	Enable outputs will pull down when axis is enabled
J12	Wired Input	Communicate with another OPTIC4 over wires (this OPTIC4 is not connected to MPU11)	Communicate with MPU11 through fiber connectors
J8	Fiber Repeat	Drivebus out to another drive connects with fiber optics (factory hardwired if all 4 fiber connectors are installed)	Drivebus out connects to another drive over wires
J10	Config	Offset and gain trim - NEVER INSTALL THIS JUMPER	Normal operation
J9	Aux 1	Spare	Spare
J11	Aux 2	Spare	Spare

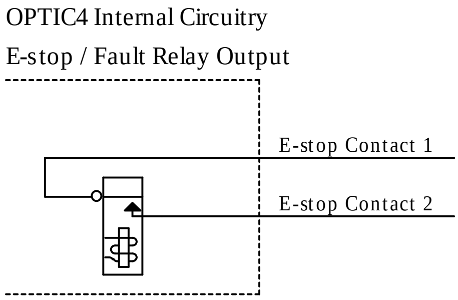
Motor Brake Outputs

Open collector brake driver outputs are provided for each axis. These outputs may be used to drive a relay to release axis brake solenoids. Note that the OPTIC4 has a built in diode to suppress transients that should be connected to the relay coil positive supply. This feature does not eliminate the need for noise suppression devices located close to the relay coil. Motor brake mechanisms may also require noise suppression, such as a resistor and capacitor network for AC solenoids or a diode for DC solenoids.

Typical Brake Wiring Example



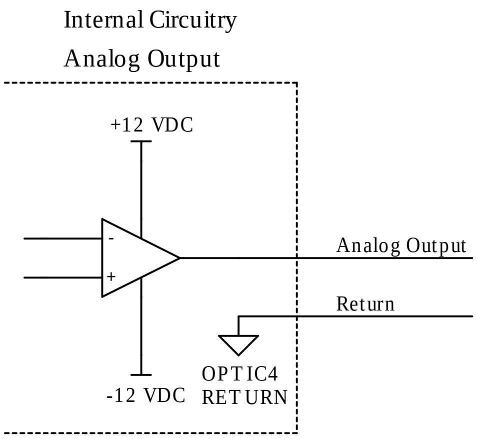




Analog Outputs

Eight analog outputs are provided by the OPTIC4. Four analog outputs are used to request motion from servo drives. Four analog outputs provide a simulated tachometer signal derived from the encoder inputs. All analog outputs have 16 bit resolution and a fixed output range of -10V to +10V. Analog channels are digitally trimmed at the factory and can not be adjusted on the PCB. See the "CNC11 Tach Parameters for OPTIC4" section for information on setting the output range for the simulated tachometers.

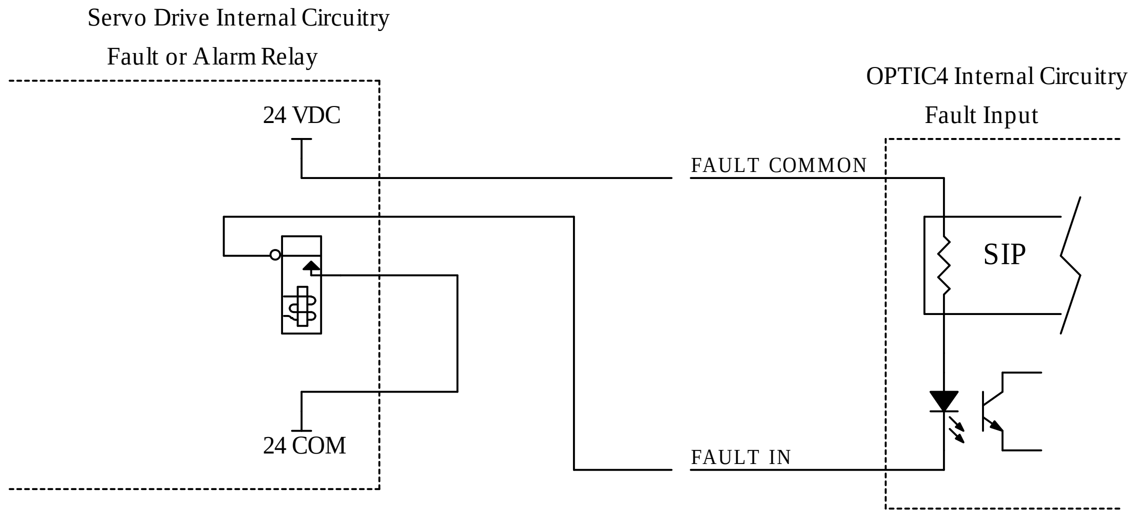
Analog signals should be wired with a paired return wire. Ideally, each analog signal will be wired with a shielded, twisted pair cable. Other signals, such as relay control, should not use the return wire dedicated to an analog output. Careful routing of analog wires away from digital signals and power sources will further reduce the chance of electrical noise pickup.



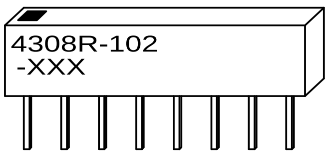
Fault Inputs

Fault inputs are provided for each axis. The input voltage may be from 5 VDC to 24 VDC, but all four faults must operate from the same voltage. The SIP resistor pack (R69) must be appropriate for the input voltage.

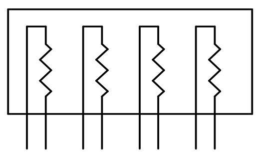
Typical Fault Input Wiring Example



SIP Identification - XXX Indicates Value



SIP Internal Wiring / Pinout



SIP Input Voltage Selection

SIP Value Marking	Resistor Value (Ohms)	Input Voltage
471	470	5
122	1.2k	12
222	2.2k	24

OPTIC4 PLC Communication

Inputs and outputs can be accessed from the PLC program. Because Optic4 communicates on the drive protocol, inputs must be accessed through SV_DRIVE_STATUS_1 - SV_DRIVE_STATUS_8 and outputs must be written through SV_DRIVE_CONTROL_1 - SV_DRIVE_CONTROL_8. The drive fault and auxiliary output bits are the only bits that will normally be accessed from the PLC program. Other status and control bits are handled through the CNC11 software.

PLC I/O Map

SV_DRIVE_STATUS_x Bits		SV_DRIVE_CONTROL_x Bits	
0	Not used	0	Not used
1	Not used	1	Not used
2	Not used	2	Not used
3	Not used	3	Not used
4	Not used	4	Not used
5	Not used	5	Not used
6	Not used	6	Not used
7	Not used	7	Not used
8	Not used	8	Not used
9	Not used	9	Not used
10	Not used	10	Not used
11	Quadrature error	11	Not used
12	Direction bit	12	Not used
13	Index Pulse	13	Tach direction inversion *
14	Differential error on encoder A or B channel	14	Auxiliary output
15	Drive fault from third party drive (1 = Fault, or no voltage at input)	15	Axis Enable ^

* Tach direction inversion is controlled by parameters 200-207, do not attempt to change

^ Axis Enable is controlled by the MPU11 firmware, do not attempt to change

CNC11 Software Setup

Drive and encoder assignment parameters must be set for each OPTIC4 board. Parameters 300 to 307 define the OPTIC4 number that will be used for each axis in the software. When setting up OPTIC4, the drive assignment parameter values may be 1 through 8. For example, parameter 300 may be set to 1 to use OPTIC4 axis 1 (displayed on LED1) as the first axis. Parameter 301 – 303 would normally be set to 2 – 4 respectively to map the remaining axes on the OPTIC4 board.

Encoder parameters 308 to 315 define the encoder port that will be used for each axis in the software. OPTIC4 boards transmit encoder information over the DriveBus protocol, so the numbers entered into parameters 308 to 315 will be from 7 to 14. For example, parameter 308 will be set to 7 to use the encoder from OPTIC4 axis 1 for axis 1 in the software.

The configuration chapter of the M-Series Operator’s Manual contains additional information on the drive assignment and encoder assignment parameters.

CNC11 Assignment Parameters for OPTIC4

Parameter	Description	Valid Values	Notes
300	CNC11 axis 1 assignment	1 to 8	The OPTIC4 base axis number is displayed on LED1 to aid in setting these parameters.
301	CNC11 axis 2 assignment	1 to 8	
302	CNC11 axis 3 assignment	1 to 8	
303	CNC11 axis 4 assignment	1 to 8	
304	CNC11 axis 5 assignment	1 to 8	
305	CNC11 axis 6 assignment	1 to 8	
306	CNC11 axis 7 assignment	1 to 8	
307	CNC11 axis 8 assignment	1 to 8	
308	CNC11 encoder 1 assignment	7 to 14	OPTIC4 encoder numbers start at 7 for OPTIC4 axis 1 and continue through 10. If a second OPTIC4 is connected, its encoder numbers will be 11 through 14.
309	CNC11 encoder 2 assignment	7 to 14	
310	CNC11 encoder 3 assignment	7 to 14	
311	CNC11 encoder 4 assignment	7 to 14	
312	CNC11 encoder 5 assignment	7 to 14	
313	CNC11 encoder 6 assignment	7 to 14	
314	CNC11 encoder 7 assignment	7 to 14	
315	CNC11 encoder 8 assignment	7 to 14	

OPTIC4 has the unique ability to simulate tachometer feedback signals from quadrature encoder inputs. This feature allows OPTIC4 to interface with drives that require tachometer feedback, while providing encoder feedback to the control. The tach analog outputs have a range of -10 to 10 VDC. The full output range is not normally used and the scaling factor must be adjusted for the application through parameters 200 - 207. A negative value may be entered in the parameters to invert the output.

CNC11 Tach Parameters for OPTIC4

Parameter	Description	Notes
200	Axis 1 Volts / 1000RPM	The encoder counts per revolution must be set correctly, as well as this set of parameters, in order for the OPTIC4 to generate a correct tachometer output. The motor menu in CNC11 (<F1>,<F3>,<F2>,<F2>) is used to change the encoder counts / rev. These parameters may be negative to invert the tach analog output. A typical setting is 3, which means 3 volts will be output for every 1000 RPM of motor speed.
201	Axis 2 Volts / 1000RPM	
202	Axis 3 Volts / 1000RPM	
203	Axis 4 Volts / 1000RPM	
204	Axis 5 Volts / 1000RPM	
205	Axis 6 Volts / 1000RPM	
206	Axis 7 Volts / 1000RPM	
207	Axis 8 Volts / 1000RPM	

OPTIC4 Specifications

Characteristic	Min.	Typ.	Max.	Unit
5 Volt Supply Current	0.5	-	-	A
12 Volt Supply Current	0.25	-	-	A
Open Collector Output Current	-	10	90	mA
Open Collector Output Voltage	-	5	25	V
Relay Output Current	0.1	-	10	A @ 125VAC
Relay Output Current	0.1	-	5	A @ 30VDC
Input Operating current	9	11	15	mA
Analog Output Resolution	-	16	-	bits
Analog Output Voltage	-10	-	10	V
Analog Output Current	0	1	20	mA
Fiber 4 and 5 Length	-	-	100	feet
Size: 12 * 5 * 0.75 (W*D*H)				Inches

OPTIC4 Troubleshooting

Symptom	Possible Cause	Corrective Action
+5V, +12V, or -12V LED not lit	power connection to H1 is faulty	correct wiring or power supply problem
FPGA OK LED not lit	power not applied to board	see +5V, +12V, or -12V LEDs
	damaged OPTIC4	return for repair
ENABLE LED not lit and no error on LED1	Main enable off	Check for errors in software preventing MPU11 from enabling drives
Tach output is not stable and has a square wave shape when viewed on an oscilloscope	Encoder is bad - 'A' channel duty cycle is not 50% at constant velocity	Adjust encoder if possible, or replace encoder

LED1 Error Codes

Error Number	Meaning	Cause	Corrective Action
1	Communication Failure	The OPTIC4 has lost communication from the MPU11	Make sure MPU11 is connected and running. Check fiber 4 or wired connection. Make sure "WIRED INPUT" jumper is set properly.
2	Not Used		
3	Not Used		
4	Not Used		
5	Not Used		
6	Not Used		
7	Not Used		
8	Not Used		
9	Not Used		

OPTIC4 Connections and Mounting Footprint