OIPC540

Power control board: 5 input, 4 pwr output

General Description

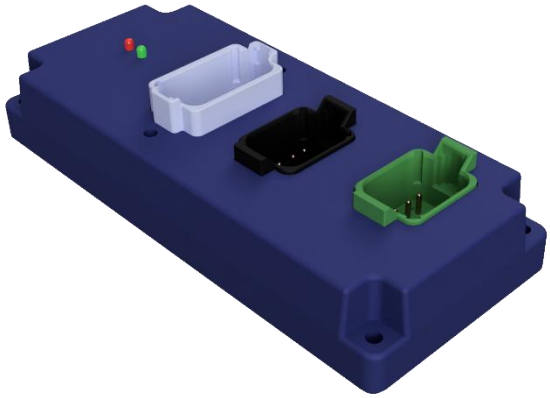
OIPC540 is a power controller with CAN bus interface, designed to supply power and manage control functions in mobile applications. This electronic power distributor serves as a smart and cost-effective electronic control unit (ECU), customized to meet the specific needs of the customer. This customization ensures that there is no wastage of input, output, or processing power, as the device is tailored to perform the desired functions efficiently.
The OIPC540 can detect up to five digital inputs and control up to four digital outputs, operating in 5-input mode strategy.
The device is protected against ESD, electrical disturbance and moisture.
The OIPC540 can also receive and interpret CAN messages from Bobcat Skidsteer joysticks to operate its outputs.

Applications

Power control units in mobile machines

Valve, pumps, actuators power supply

SMART controllers for special tools



Features

- **Low cost and tailored solution**
- **IP67**
- **12/24V DC power supply, integrated fuses**
- **5 digital input lines (black connector)**
- **4 digital power outputs (grey connector)**
- **CAN interface (green connector)**
- **Flyback diodes on each power output line**
- **CAN bootloader for firmware updates**
- **Coded connectors avoiding mismatches**
- **Simple and reliable**

Ordering Information

OIPC540	Power controller, 5 input commands 4 power outputs, CAN interface

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Min	Max	Unit
Ts	Storage temperature	-20	70	°C
T_A	Operating Temperature Range	-20	65	°C
V_{CC}	Supply Voltage Range (DC voltage)	9	36	V

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rated conditions for extended periods may affect device reliability.

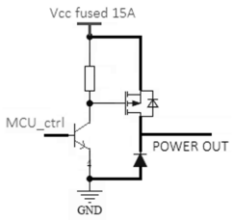
TECHNICAL CHARACTERISTICS

T_A = 25°C, unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{SUPPLY}	Supply Voltage Range	-20 < T_A < +70	10	12	30	V
I_{SUPPLY}	Current consumption	Inputs and outputs dis-connected		15		mA
I_{fuse_logic}	Logic-fusing			2		A
I_{fuse_out}	Output-fusing			15		A
N_{DIN}	Number of Digital Inputs			5		-
N_{DPOUT}	Number of Digital Power Outputs			4		-
N_{DSOUT}	Number of Digital Signal Outputs			0		-
N_{CAN}	Number of CAN interfaces			1		-

POWER OUTPUTS SPECIFICATIONS

The power output stages function as high-side switches, meaning the load must be connected between the output pin and 0V. Freewheeling diodes are already included on the board to mitigate any inductive effect. The power outputs are safe-guarded by a single 15A fuse (fuse 1).

POWER OUT#	FUNCTION	MAX OUTPUT CURRENT [A]	POWER OUTPUTS STAGE CIRCUIT
DO1	DIVERTER UP/SHIFT R	2	
DO2	DIVERTER DW/SHIFT L		
DO3	SLEDGE CTRL		
DO6	WATER PUMP	6	

DIGITAL INPUTS SPECIFICATIONS

The inputs are sensitive to the rising edge of the signal. Typically, the input should remain at a low level (0V) so that the logic can detect the transition from low to high (when the voltage rises from 0V to +Vcc). If the assigned function for the input is **maintained**, the system will keep the function active as long as the input remains high. Conversely, if the assigned function is **latched**, the function will stay active until a second low-to-high transition is detected (see Figure 1). For every OIPC540 power output, it is possible to set an OFF-delay time using dedicated CAN register. The delay time postpones the output turn OFF in relation to the input state (Figure 1). Floating inputs are always treated as equal to a low level (0V).

INPUT	DESCRIPTION	CONDITIONS	Max LOW level	Min HIGH level	Unit
DI1	Digital input 1	Normally low	1	5	V
DI2	Digital input 2	Normally low	1	5	V
DI3	Digital input 3	Normally low	1	5	V
DI4	Digital input 4	Normally low	1	5	V
DI5	Digital input 5	Normally low	1	5	V

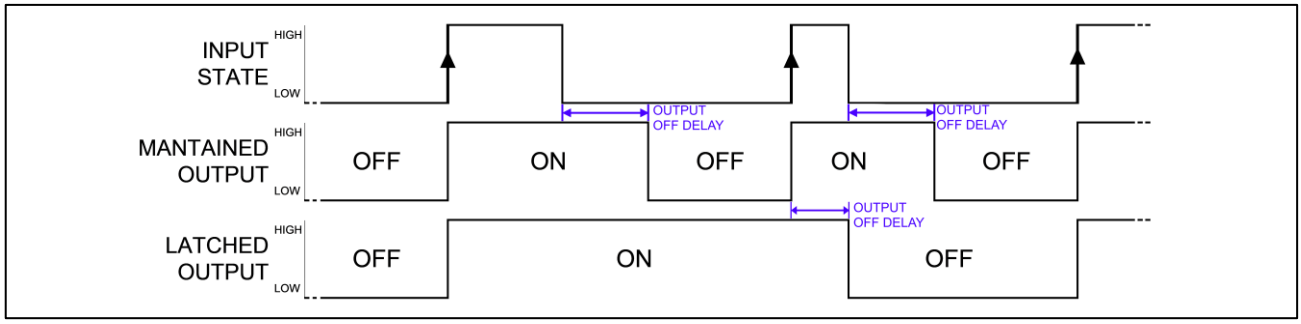


Figure 1 - Maintained versus latched output logic, in relation to positive transitions of inputs

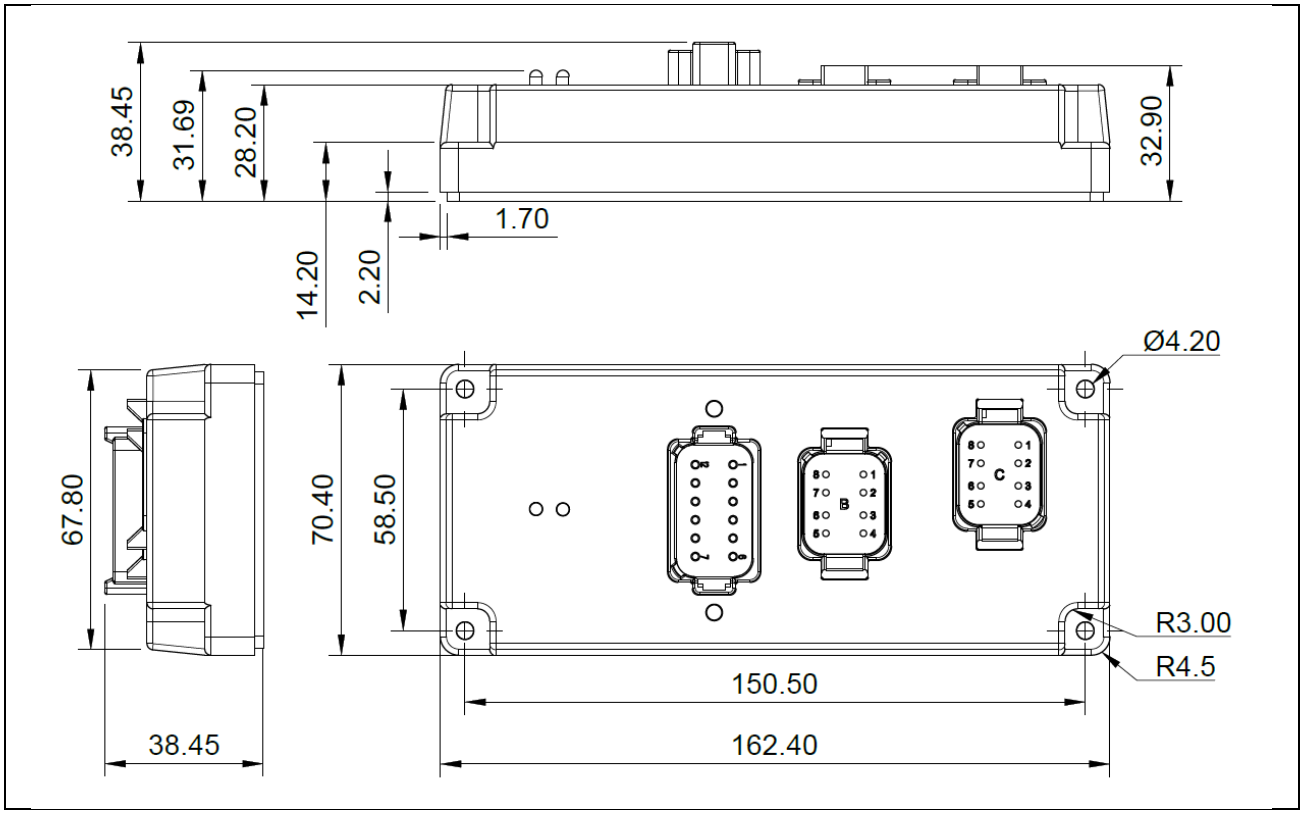
CONTROL STRATEGY: INPUT'S FUNCTION AND ASSIGNED OUTPUT

	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5
FUNCTION	SLEDGE UP	SLEDGE DOWN	SHIFT RIGHT	SHIFT LEFT	WATER PUMP
OUTPUT ACTION	DO1 + DO3 MANTAINED	DO2 + DO3 MANTAINED	DO1 MANTAINED	DO2 MANTAINED	DO6 LATCHED

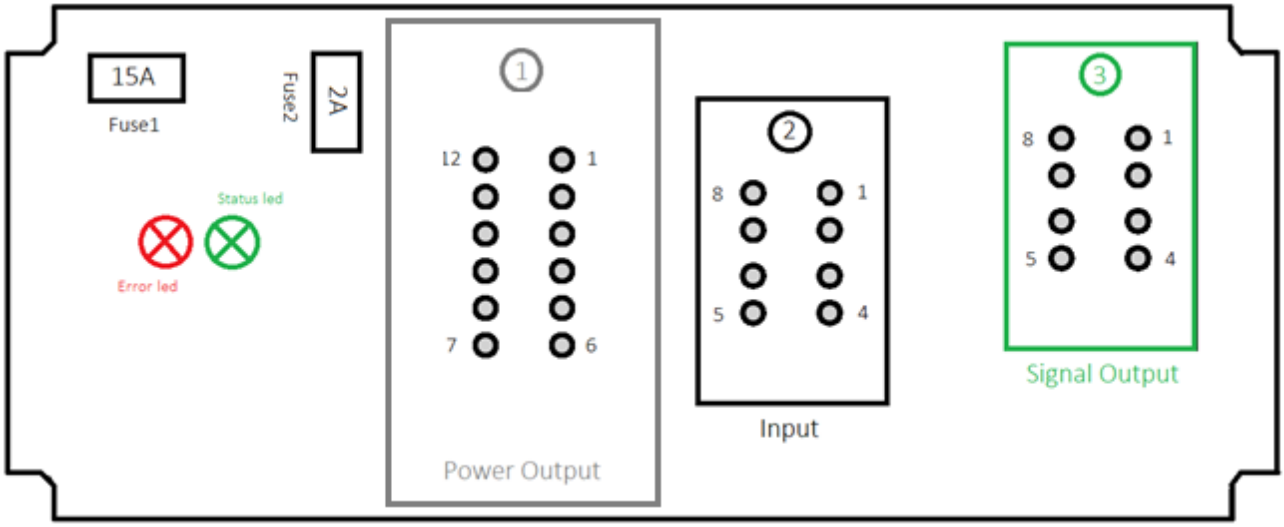
MECHANICAL CHARACTERISTICS AND DIMENSIONS

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
W	Width			70,4		mm
L	Length			162,4		mm
H	Height			37,7		mm
W	Weight			275		g

Unit: mm, tolerance ±0.2mm

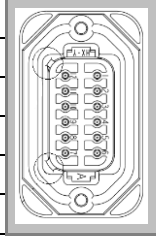


PIN FUNCTIONS

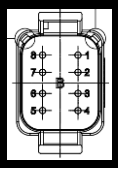


POWER SUPPLY AND POWER OUTPUTS CONNECTOR (GREY)

The power outputs are safeguarded by a single 15A fuse (fuse 1).

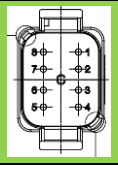
Name	Symbol	No	DT15-12PA	No	Symbol	Name
POSITIVE POWER SUPPLY	+Vcc	12		1	+Vcc	POSITIVE POWER SUPPLY
DIGITAL POWER OUT 2	DO2	11		2	DO1	DIGITAL POWER OUT 1
OIPC540 NOT AVAILABLE	*DO4*	10		3	DO3	DIGITAL POWER OUT 3
DIGITAL POWER OUT 6	DO6	9		4	*DO5*	*OIPC540 NOT AVAILABLE*
OIPC540 NOT AVAILABLE	*DO8*	8		5	*DO7*	*OIPC540 NOT AVAILABLE*
NEGATIVE POWER SUPPLY	0V	7		6	0V	NEGATIVE POWER SUPPLY

DIGITAL INPUTS CONNECTOR (BLACK)

Name	Symbol	No	AT04-08PB	No	Symbol	Name
SIGNAL GROUND	GND	8		1	+Vo	PWR SUPPLY OUT 15A FUSED
DIGITAL INPUT 2	DI2	7		2	DI1	DIGITAL INPUT 1
DIGITAL INPUT 4	DI4	6		3	DI3	DIGITAL INPUT 3
OIPC540 NOT AVAILABLE	*DI6*	5		4	DI5	DIGITAL INPUT 5

CAN AND DIGITAL SIGNAL OUTPUTS CONNECTOR (GREEN)

The digital signal outputs are protected by a single 2A fuse (fuse 2).

Name	Symbol	No	AT04-08PC	No	Symbol	Name
OIPC540 NOT AVAILABLE	*DL2*	8		1	*DL1*	*OIPC540 NOT AVAILABLE*
OIPC540 NOT AVAILABLE	*DL4*	7		2	*DL3*	*OIPC540 NOT AVAILABLE*
SIGNAL GROUND	GND	6		3	*DL5*	*OIPC540 NOT AVAILABLE*
CAN LOW	CANL	5		4	CANH	CAN HIGH

OIPC540 BOBCAT CAN MESSAGE SUPPORT

The OIPC540 can read and interpret the CAN data frame transmitted by Bobcat Skidsteer Joysticks and actuate the 4 power outputs. When the Bobcat skidsteer joysticks support is active (shortened to BCAT mode), the values of the digital inputs are ignored. The digital inputs lines are replaced by a corresponding bit in the data received from the Bobcat skid-steer joysticks. In BCAT mode, the OIPC540 can only receive CAN frames and does not transmit, avoiding every possible interference with the machine's CAN network.

BCAT mode supported Bobcat skidsteer joysticks frame

The OIPC540 in BCAT mode supports only joysticks frame with extended ID (29-bit) equal to 14FFFFB0h. The joystick retransmit this frame every 100ms. If the communication with the joystick is lost, a 150ms timeout reset the digital input register and all the OIPC540 outputs is turned OFF with the programmed turn OFF delay time.

BCAT mode activation/de-activation

The OIPC540 automatically switches to BCAT mode as soon as it receives the first joystick data frame from a Bobcat skid steer. Within the OIPC540, there is a timeout specifically for disabling BCAT mode. If the joystick stops sending data frames for a duration longer than the programmed disable-timeout, the OIPC540 will exit BCAT mode and revert to regular operation, where power output is controlled by the electrical digital inputs (DIN). Each time a Bobcat skid steer joystick data frame is received, the disable-timer resets to zero. The default disable timeout is set to 1 second but can be adjusted from 0.15 seconds to 60 seconds.

BCAT mode inputs

To read the state of the joystick buttons transmitted in the CAN data frame, the OIPC685 must be in the NMT operational state with the BCAT mode active. The input logic state activates the corresponding function upon a positive transition of the bit from '0' to '1' (like the electrical digital input lines). Maintained outputs will stay active as long as the input remains high. In contrast, toggled outputs will switch states based on the positive transitions of the bit from '0' to '1' (see Figure 1).

Digital Input #	Equivalent Bobcat Joystick Control	Function	Bobcat Joystick CAN frame Byte #	Bit # of the byte
1	LCU	Input1 (sledge up)	3	0
2	LCD	Input 2 (sledge down)	3	1
3	RCU	Input 3 (shift right)	3	2
4	RCD	Input 4 (shift left)	3	3
5	LBL	Input 5 (water pump)	6	6

Table 1 – OIPC540 inputs with BCAT mode enabled

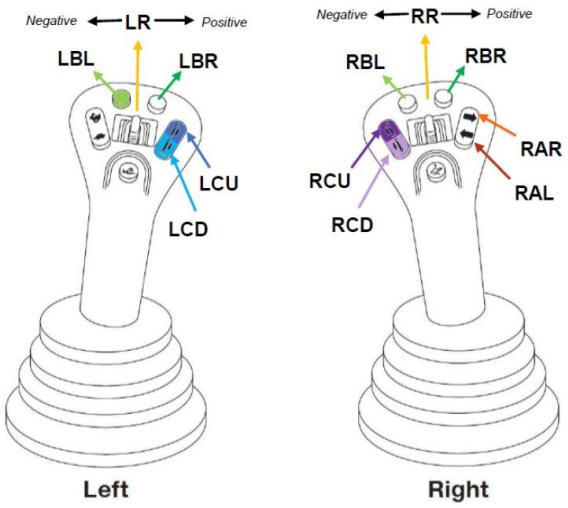


Figure 2 - Bobcat Skidsteer Joystick controls

BCAT mode LED outputs

As for the inputs, when the BCAT mode is enabled, the OIP540 follows the 5-input control strategy LED pattern.

OIPC540 CAN MANUAL

A general knowledge of CAN OPEN protocol is recommended to fully understand this manual. All the numbers contained are written in decimal format. Hexadecimal values are marked with a final "h" to distinguish them from decimal.

This document can be subjected to changes without notice and no claims can be derived from its details, illustrations, or descriptions.

CANBUS connections and termination resistors

The OIPC540 doesn't have internal bus line terminator resistor. The user must ensure two 120Ω termination resistors are installed between the CANH and CANL lines. Typically, one is located near the network master at the start of the bus. The other should be at the end of the CANBUS, on the furthest node of the CAN network.

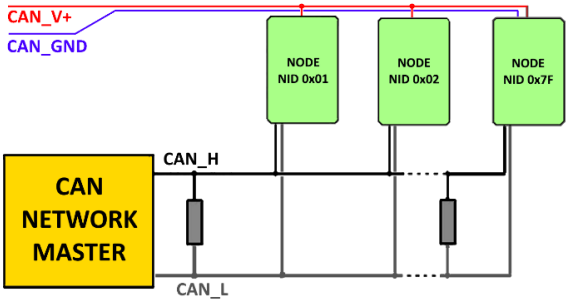


Figure 3 – CAN BUS network typical wiring scheme

CANopen

CANopen (EN 50325-4) is a high-level CAN-based communication protocol, developed for embedded networking applications (e.g.: in-vehicle networks). CANopen comprises and standardizes many aspects of a communication protocol like network programming framework, device descriptions, interface definitions and application profiles, enabling different devices and applications from different manufacturers to communicate.

OIPC540 receiver meets CiA 301 v.4.2.0 requirements for a general-purpose CANopen network node. No device profile is specified for wireless receiver.

Supported communication objects

OIPC540 supports CAN frames with 11-bit node identifiers to access the configuration and data registers plus extended CAN ID with 29-bit identifiers to receive CAN message transmitted by the Bobcat *skidsteer* joysticks. During the initialization phase, all the different 11-bit COB-ID identifiers values are computed starting from the dictionary object values.

Communication object	Direction [†]	COB – ID	Object description	works in BCAT mode
NMT	RX	00h	NMT services	YES
SYNC	RX	80h	Sync object	YES
EMCY	TX	80h + NID	Emergency object	NO
SDO (Client→Server)	RX	600h + NID	Access to a node object dictionary	YES
SDO (Server→Client)	TX	580h + NID	Node reply to SDO request	NO
Boot Up \ Heartbeat	TX	700h + NID	Boot Up and Heartbeat messages	NO

Table 2 - communication objects supported by OIPC540

[†] *Direction is considered from the point of view of OIPC540. CANopen SDO standard communication protocol defines the device on which the object dictionary table resides as master device.*

Boot-Up frame

The OIPC540 initialization process starts as soon as the device is powered on. This process takes around 100ms to finish. As soon as initialization is complete, the device sends a boot-up frame (see Table 3) to advise it has entered the pre-operational state.

COB-ID	Byte 0
700h + NID	00h

Table 3 –Boot-Up message frame

NMT finite state machine

A CANopen device's behavior depends on the state of a *finite state machine* (see Figure 4). Each state defines the node's behavior, the valid communication objects and the possible actions. By default, the OIPC540 enters the NMT operational state immediately after the boot-up delay timer elapses and the Boot-Up frame is transmitted.

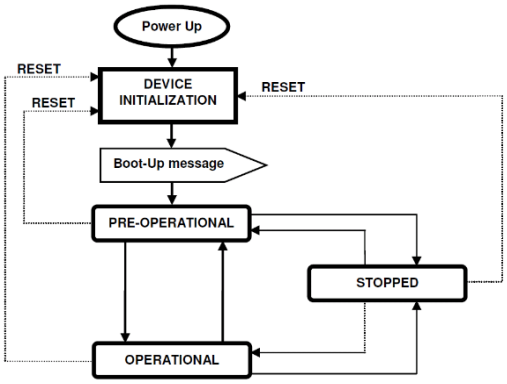


Figure 4 – NMT state machine of CANopen nodes

NMT command frames (refer to Table 4) are used to change the active state of the NMT finite state machine. The NMT command frames are made by two data bytes. The first byte of the NMT command code (refer to Table 5) specifies the command itself, while the second byte indicates whether the command applies to all nodes in the network or just a specific one. If the value of the second data byte (byte 1) is 00h, the NMT command frame is sent to all nodes in the network. Otherwise, it specifies the address of the individual node to which the command applies.

A node in the *pre-operational* state, can transmit heartbeat messages (when this service is configured). In the pre-operational NMT state, the SDO protocol must be used to configure or read data. Devices in *stopped* state only process NMT commands. A *stopped* device indicates its current NMT state by supporting the error control protocol (heartbeat).

COB ID (11bit)	Byte0	Byte1	
000h	COMMAND CODE (see Table 5)	00h	broadcast NMT command to all the nodes of the network
		NID	send NMT command to a specific node

Table 4 – NMT command frame organization

COMMAND CODE	EFFECT ON NMT STATE MACHINE
01h	Go to OPERATIONAL
02h	Go to STOPPED
80h	Go to PRE – OPERATIONAL
81h	Go to RESET NODE
82h	Go to RESET COMMUNICATIONS

Table 5 – NMT command code values

SDO Read

The read operation for a device's object dictionary entry starts with an SDO upload request frame. The frame first data byte (byte 0) indicates the data type of the entry to be read from the dictionary.

COB ID	Byte0	Byte1	Byte2	Byte3
600h + NID	RD data type [‡] (Table 7)	Index Low (LSB)	Index High (MSB)	Sub-Index

Table 6 – organization of an SDO read request frame.

OD entry type	RD data type
Read any length	40h
1 byte	4Fh
2 bytes	4Bh
4 bytes	43h
STRING	41h

Table 7 – possible RD data type values for SDO read request frame.

A successful reading operation returns the object's value in the response frame. The value can be an 8-bit, 16-bit, or 32-bit number or 1 to 4 ASCII characters for string-type entries. If the object's value is shorter than 4 bytes, the unused bytes are omitted, resulting in a shorter response frame. The 16-bit and 32-bit object's values are returned starting from the least significant byte (LSB) to the most significant byte (MSB).

COB ID	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
580h + NID	Data type (Table 7)	Index Low (LSB)	Index High (MSB)	Sub-Index	Entry Value (LSB to MSB)			

Table 8 – organization of an SDO read response data frame.

In BCAT mode, the OIPC540 receives SDO frames but does not transmit any frames. As a result, there will be no SDO response or SDO error frame sent after an SDO Read request.

SDO Write

The write operation to a device object dictionary entry starts with an SDO download request frame. The first data byte (byte 0) indicates the data type to be written.

COB ID	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
600h + NID	WR data type [§] (Table 10)	Index Low (LSB)	Index High (MSB)	Sub-Index	Write Value (LSB to MSB)			

Table 9 – organization of an SDO write request frame.

The value can be an 8-bit, 16-bit, or 32-bit number, fitting into the value field (bytes 4 to 7), and must match the object dictionary entry type. If the value is shorter than 4 bytes, transmitting unused bytes is unnecessary. To write 16-bit and 32-bit value to an object, the SDO frame's data bytes must be written starting from the least significant byte (LSB) to the most significant byte (MSB).

OD entry type	WR data type
Write any length	22h
1 byte	2Fh
2 bytes	2Bh
4 bytes	23h

Table 10 – possible WR data type values for SDO write request frame

‡ *If the entry data type isn't known, it's* possible to use the "Read any length" (40h) data type in the SDO upload frames.
§ If the entry data type isn't known, it's *possible to use the "Write any length" (22h) data type in the SDO download frames.*

An error-free write operation is confirmed by an SDO response frame: byte 0 equals 60h, indicates the successful writing of the new value. The index and sub-index values are repeated in the response, and bytes 4 to 7 are all set to zero.

COB ID	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
580h + NID	60h	Index Low (LSB)	Index High (MSB)	Sub-Index	00h	00h	00h	00h

Table 11 – organization of an SDO download response data frame.

In BCAT mode, the OIPC540 receives SDO frames but does not transmit any frames. As a result, there will be no SDO response or SDO error frame sent after an SDO Read request.

SDO ERRORS CODES

When an DSO read or write operation fails the OIPC540 answers with an SDO abort frame. The first data byte (byte 0) of the abort frame is set to 80h to signal an error condition. The index and the sub-index values are included in the abort frame to specify which entry has encountered the error. The value field of the abort frame contains the 4-byte long SDO abort code, that identifies the reason for the error (refer to Table 13).

COB ID	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
580h + NID	80h	Index Low (LSB)	Index High (MSB)	Sub-Index	SDO abort code (Table 13) (LSB to MSB)			

Table 12 – organization of an SDO download request frame.

SDO abort code	Bytes 4 to 7	Error
0504 0001h	01h; 00h; 04h; 05h	SDO command not valid or unknown
0601 0002h	02h; 00h; 01h; 06h	Attempt to write a read-only object
0602 0000h	00h; 00h; 02h; 06h	Object does not exist in the object dictionary
0604 0043h	43h; 00h; 04h; 06h	General incompatibility reason
0607 0010h	10h; 00h; 07h; 06h	Data type does not match; length of service does not match
0609 0011h	11h; 00h; 09h; 06h	Sub-index does not exist
0609 0030h	30h; 00h; 09h; 06h	Parameter invalid value (download only)
0609 0031h	31h; 00h; 09h; 06h	Value of written parameter too high
0609 0032h	32h; 00h; 09h; 06h	Value of written parameter too low
0800 0000h	00h; 00h; 00h; 08h	General Error
0800 0020h	20h; 00h; 00h; 08h	Data cannot be transferred or stored to/in the application
0800 0024h	24h; 00h; 00h; 08h	No data available

Table 13 – SDO abort codes list for SDO abort frames

OBJECT DICTIONARY

Index	Sub-index	Parameter description	Data Type	Access	Default	Range	NVM Saved
1000h	00h	Device type (device profile unknown)	UNS32	RO	00000000h		
1001h	00h	Error register	UNS8	RO	00h		
1002h	00h	Manufacturer error register	UNS32	RO	00000000h		
1003h	Pre-defined error field						
	00h	Largest supported sub-index	UNS8	RO	05h		
	01h	error[0]	UNS32	RO	00000000h		
	02h	error[1]	UNS32	RO	00000000h		
	03h	error[2]	UNS32	RO	00000000h		
	04h	error[3]	UNS32	RO	00000000h		
	05h	error[4]	UNS32	RO	00000000h		
1005h	00h	COB-ID Sync object	UNS32	RW	0000080h	001h...7FFh	YES
100Ah	00h	Manufacturer software version	UNS32	RO	{rev.dep.}		
100Ch	00h	Guard time [ms]	UNS16	RW	0000h	0001h…FFFFh	YES
100Dh	00h	Life time factor	UNS8	RW	00h	01h…FFh	YES
1010h	Save parameters						
	00h	Largest supported sub-index	UNS8	RO	01h		
	01h	Save ALL parameters ("save" = 73617665h)	UNS32	RW	00000001h		
1011h	Restore all parameters						
	00h	Largest supported sub-index	UNS8	RO	01h		
	01h	Reload ALL parameters ("load" = 6C6F6164h)	UNS32	RW	00000001h		
1014h	00h	COB-ID Emergency object	UNS32	RO	80h + NID		
1017h	00h	Producer Heartbeat interval time [multiple of 1ms, 0 = disabled]	UNS16	RW	0000h	0000h...FFFFh	YES
1018h	Identity object						
	00h	Largest supported sub-index	UNS8	RO	04h		
	01h	Vendor ID	UNS32	RO	00000000h		
	02h	Product code	UNS32	RO	00000000h		
	03h	HW Revision	UNS32	RO	00000000h		
	04h	Serial number and lot number	UNS32	RO	00000000h		

Index	Sub-index	Parameter description	Data Type	Access	Default	Range	NVM Saved
1200h	Server SDO1 parameters						
	00h	Largest supported sub-index	UNS8	RO	02h		
	01h	COB-ID Client > Server	UNS32	RO	600h + NID		
	02h	COB-ID Server > Client	UNS32	RO	580h + NID		
2000h	00h	Node ID	UNS8	RW	0Dh	01h...7Fh	YES
2001h	00h	Baud Rate [kBit\s]	UNS8	RO	01h	[00h] – 125kbps [01h] – 250kbps [02h] – 500kbps [03h] – 1000kbps	YES
2002h	00h	Restore defualt Node ID	UNS32	RW			
3000h	00h	Digital inputs register	UNS8	RO	00h		
3200h	00h	Power outputs register	UNS8	RW	00h		
3300h	00h	Signal outpust register	UNS8	RO	01h		
4000h	00h	Active contol strategy	UNS8	RO	00h		
4001h	00h	Active function	UNS8	RO	01h		
4003h	BCAT mode register						
	00h	Largest supported sub-index	UNS8	RO	02h		
	01h	BACT mode enable	UNS8	RO	00h	[00h] OFF [01h] ON	
	02h	Disable-Timeout Time [ms]	UNS16	RW	03E8h	0096h – EA60h	YES
4100h	Power Output turn OFF delay time						
	00h	Largest supported sub-index	UNS8	RO	08h		
	01h	Output #1 OFF delay [ms]	UNS16	RW	00h	0000h – 1388h	YES
	02h	Output #2 OFF delay [ms]	UNS16	RW	00h	0000h – 1388h	YES
	03h	Output #3 OFF delay [ms]	UNS16	RW	C8h	0000h – 1388h	YES
	04h	*Output #4 NOT PRESENT*					
	05h	*Output #5 NOT PRESENT*					
	06h	Output #6 OFF delay [ms]	UNS16	RW	00h	0000h – 1388h	YES
	07h	*Output #7 NOT PRESENT*					
	08h	*Output #8 NOT PRESENT*					
5002h	00h	Boot Delay Timer [multiple of 1ms]	UNS16	RW	50	32h…7530h	YES
5003h	00h	CANBUS error control register	UNS8	RW	0	00h…07h	YES
5004h	00h	Auto operational mode	UNS8	RW	1	[00h] - Off [01h] - On	YES

Note: In BCAT mode, the SDO frames are received by the OIPC540, but no response is transmitted. This means that the register values can be modified, but no SDO response or SDO error frame will be sent.

Save All – 1010h

This object initiates the process of storing device configuration parameters in its permanent memory. The function for saving all parameters is available. The permanent memory writing process begins only when a specific signature is written to sub-index 01h. This signature is "*save*," represented in hexadecimal as 65h 76h 61h 73. When the non-volatile memory writing process ends, the device signals the success of the saving process with an SDO response frame (or an SDO abort frame in case of error).

Reload All – 1011h

This object initiates the process for restoring the device's default factory configuration. The function to restore all the parameters is available. The permanent memory writing process is initiated only when a specific signature is written to sub-index 01h. This signature is the word "*load*", represented as 64h 61h 6Fh 65h. Upon receiving the load signature, the device restores all parameters in its permanent memory to their default factory values. When the non-volatile memory writing process ends, the device signals the success of the restoring process with an SDO response frame (or an SDO abort frame in case of error). It is strongly recommended to reset the control board by performing a power cycle after the default values have been restored.
The *reload all* command does not affect the node identifier and the bit rate settings. Any changes to the node identifier and bit rate must be made through an explicit SDO write request frame. To make the new values effective, they must first be stored in permanent memory, after which the device will reboot.

Digital inputs register – 3000h

In normal operating mode, the digital input register reflects the current state of the OIPC540 electrical input lines. The value of the digital input register determines the active function outputs state.

Digital inputs register							
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
			DI5	DI4	DI3	DI2	DI1

Table 14 – Meaning of the individual bit composing the digital inputs register (empty bytes are not used, and their value is always zero)

Power outputs register – 3200h

In normal operating mode (BCAT mode disabled), the power output register reflects the current state of the OIPC540 power output lines. A value of '1' means the power output is ON while a value of '0' means the power output is OFF.

Digital outputs register							
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
		DO6			DO3	DO2	DO1

Table 15 – Meaning of the individual bit composing the power outputs register

BCAT mode register – 4003h

The OIPC540 automatically switches to BCAT mode as soon as it receives the first joystick data frame from a Bobcat skid steer. Within the OIPC540, there is a timeout feature specifically for disabling BCAT mode. If the joystick stops sending data frames for a duration longer than the programmed disable-timeout, the OIPC540 will exit BCAT mode and revert to regular operation, where power output is controlled by the electrical digital inputs (DIN). Each time a Bobcat skid steer joystick data frame is received, the disable-timer resets to zero. The default disable timeout is set to 1 second but can be adjusted from 0.15 seconds to 60 seconds.

Power outputs OFF delay time - 4100h

The power output OFF delay time register consists of eight sub-indices, one for each power output. The intended delay time is measured from the falling edge of the input for maintained outputs, and from the second rising edge of the input for latched outputs (refer to Figure 1). Each sub-index value specifies the OFF-delay time for the corresponding output expressed in milliseconds.

SUB-INDEX	OUTPUT	MIN VALUE [ms]	MAX VALUE [ms]	DEF VALUE [ms]
01h	DO1	0	5000	0
02h	DO2			0
03h	DO3			200
06h	DO6			0

Table 16 – power outputs OFF delay time sub-indices

OIPC540 onboard CAN LED indicators

The device features two distinct LEDs that meet the specifications outlined in CiA DR-303-3. Green led is used as status led indicator and red led is used as error led. The tables below describe all led configurations.

STATUS LED	LED state	LED state description
¤ ¤ ¤ ¤ ¤ ¤ ¤ ¤ ¤ ¤	OFF	The device is switched off
¤ ¤ ¤ ¤ ¤ ¤ ¤ ¤ ¤ ¤	Single flash	The device is in Stop mode
¤ ¤ ¤ ¤ ¤ ¤ ¤ ¤ ¤ ¤	Blinking	The device is in Pre-operational mode
¤ ¤ ¤ ¤ ¤ ¤ ¤ ¤ ¤ ¤	ON	The device is in Operational mode (default for OIPC540)
ERROR LED	**LED state**	**LED state description**
¤ ¤ ¤ ¤ ¤ ¤ ¤ ¤ ¤ ¤	OFF	The device is in working conditions
¤ ¤ ¤ ¤ ¤ ¤ ¤ ¤ ¤ ¤	Single flash	CAN warning limit reached
¤ ¤ ¤ ¤ ¤ ¤ ¤ ¤ ¤ ¤	Double flash	Loss of Guarding-master detected
¤ ¤ ¤ ¤ ¤ ¤ ¤ ¤ ¤ ¤	ON	The device is in state Bus-Off