

PLC Input and Output Diagnostic App Users Guide

CNC Software version: CNC12 v4.8 Models: Acorn, AcornSix

What is the PLC Diagnostic App?2Identifying Input and Output assignment names3Observing Input and Output Virtual LED's7Manually interacting with Input and Outputs8Simplified and Advanced PLC Diagnostic tools11

What is the PLC Diagnostic App?

A tool to observe CNC controller Inputs and Outputs. A tool to manually activate/invert/deactivate CNC controller Inputs and Outputs. Commonly used to debug any type of switches, relays, contactors, ATC's etc connected to the CNC controller.

With the CNC12 PLC Diagnostic App you can:

- Observe the state of any input or output live while the machine is running.
- 'Turn on' or 'Turn off' any input or output by clicking on it or using the keyboard live while the machine is running.
- Invert an input live while the machine is running.

PLC App introduction video.

https://youtu.be/FGgJ56p4M5Y

Using the CNC12 PLC Diagnostic app.

From the main screen of CNC12,

Start the PLC diagnostic screen by pressing the keys <ALT> and < i> at the same time.

iagnostic Screen	-
Simplified Input / Output PLC Diagnostics	INP1 : HomeAll
Acorn On Board INPUTS 1-8	
1 2 3 4 5 6 7 8	
Acorn On Board OUTPUTS 1-8	
1 2 3 4 5 6 7 8	
< Alt i > Open PLC Diagnostics press again to close PLC of	liagnostics.
< CTRL Alt i > to invert input open or closed. < CTRL Alt	> three step cycle to force an output: ON, OFF, or norma
< CTRL Alt o > Options Menu. < CTRL Alt h > for Help	

To exit from the Input and Output screen, press the keys <ALT> and <i> again at the same time.

Use the mouse (or arrow keys) to select an input and a white thin line box appears around the virtual LED and the assigned PLC Input function name for that input is displayed.

In the example below an external hard CycleStart button input has been assigned to input #2 which is named CycleStart2.

The cursor represented by a square white box is around virtual LED for Input #2 and the name of input #2 PLC function assignment appears.



Use the mouse to select an output and a white thin line box appears around the virtual LED and the assigned PLC Input function name for that input is displayed.

In the example below Output relay 8 has been assigned Spindle Forward PLC function named SpindFWD

CNC12 PLC D	iagnostic Screen	- 0	×
	Simplified Input / Output PLC Diagnostics OUT8 : SpinFWD		Î
	Acorn On Board INPUTS 1-8 1 2 3 4 5 6 7 8		
	Acorn On Board OUTPUTS 1-8 1 2 3 4 5 6 7 Acorn On Board OUTPUTS 1-8 At i > Open PLC Diagnostics proceagain to close PLC diagnostics. < CTRL Alt i > to invert input open or closed. < CTRL Alt f > three step cycle to force an output: ON, OFF, or n	normal.	

The PLC function assignment to the input and outputs are made with the CNC control setup Wizard.

Below is the Wizard PLC function input definitions setup menu for some of the examples we are using in this document

🔇 Router CNC Control Configuration Wizard

Axis Drive Type	Input Type: Router V	Acorn Integrated Inputs 1-8
- Input Definitions	Axis1DriveOk ^	
Output Definitions	Axis2DriveOk	NS NO Definition
	Axis3DriveOk	1 IN1 HomeAll
Axis	Axis4DriveOk	
 Configuration 	CycleCancel2	Z INZ CycleStart2
 Homing and Travel 	DriveOk	3 IN3 FeedHold2
- Axes Pairing	FirstAxisHomeLimitOk	
Advanced	FirstAxisHomeOk	100iCheck2
, lavaneeu	FirstAxisMinusLimitOk	5 IN5
Spindle	FirstAxisPlusLimitOk	6 IN6 ProbeDetect
	FourthAxisHomeLimitOk	
Spindle #1	FourthAxisHomeOk	7 IN7 ProbeTripped
 Rigid Tapping 	FourthAxisMinusLimitOk	8 IN8 EStopOk
- PWM Setup	FourthAxisPlusLimitOk	
	LimitAll	
Touch Devices	LubeOk	Click and Drag an Input function definition from list
– Probe	PressureLowMessage	to the Input number Definition box to assign a
Tool Touch Off	PressureLowStop	function to an input.
	RPM Sensor	Click the Input number circle to toggle the input
Control Peripheral	SafetyDoorLockConfirmed	state from NC to NO. Note: Probe Input states are
Input Devices	SafetyDoorSwitchClosed	determined in the Probe setup menus.
	SecondAxisHomeLimitOk	
	SecondAxisHomeOk	
DB25 Connector	SecondAxisMinusLimitOk	
	SecondAxisPlusLimitOk	
- Mapping		

ATC

Below is the Wizard PLC function Output definitions setup menu for some of the examples we are using in this document

ary System	Output Type: Router	V			
axis Drive Type			Acc	orn Int	egrated Outputs 1-8
Input Definitions	Axis2BrakeRelease	^			
Output Definitions	Axis4BrakeRelease				Definition
	ChargePump		1	OUT1	OUTPUT1
s	DriveResetOut		2		
Configuration	G540SpinFwdOff		-	0012	0012
Homing and Travel	G540SpinRevOtt		3	OUT3	OUTPUT3
Axes Pairing	GreenLight		4	OUT4	OUTPUT4
Advanced	LaserAlignActivate		5	OUT5	
				0015	0011013
indle	LubePump		6	OUT6	DustFootActivate
Spindle #1	NoFaultOut		7	OUT7	Axis3BrakeRelease
Rigid Tapping	OrientSpindle		8		SpinEW/D
- PWM Setup	PopUpPins		Ŭ	0010	Spini WD
	PWM Output				
uch Devices	PWMSelect				
Probe	RedLight		Click an	d Drag a	n Output function definition from
- Tool Touch Off	RouterDustCollection		function	to an o	it number Definition box to assig
	RouterVacuumHoldDown		- and a second		
ontrol Peripheral	SafetyDoorLockOpen				
Input Devices	SpindleBrakeRelease				
Wireless MPG	SpindleCoolingFan				
	SpinREV				
25 Connector	TurnClampOn				
Mapping	UnclampTool				
	VFDDirection				
c	VFDEnable				
- ΔTC Setup	VFDResetOut				
Ale betup	WorkLight				
		Y			
eferences					

If no PLC assignment has been made in the Wizard for a particular input or output they appear simply as INP1:INP1



Or OUT2: OUTPUT2, etc.

CNC12 PLC Diagnostic Screen -		×
Simplified Input / Output PLC Diagnostics OUT2 : OUTPUT2		
Acorn On Board INPUTS 1-8 1 2 3 4 5 6 7 8		
Acorn On Board OUTPUTS 1-8 1 2 3 4 5 6 7 8		
< Alt i > Open PLC Diagnostics press again to close PLC diagnostics. < CTRL Alt i > to invert input open or closed. < CTRL Alt f > three step cycle to force an output: ON, OFF, or nor < CTRL Alt o > Options Menu. < CTRL Alt h > for Help	mal.	

Even if an input or output is not assigned a PLC function they can still be observed manipulated with the PLC Diagnostic App.

Observing the Inputs and Outputs:

Input LED colors explained.

A red Virtual LED for an Input indicates that Input is "open" A green Virtual LED for an Input indicates that Input is "closed"

When an input in the Wizard is set to NC (Normally Closed) the PLC diagnostic LED will appear Green when the input is made (aka closed), see below.



When an input in the Wizard is set to NO (Normally Open) the PLC diagnostic LED will be appear as below. A white line above the Virtual LED indicates that particular input has been Inverted (set to Normally Open).



A green Virtual LED with a line above it is inverted and indicates that Input is "open" A red Virtual LED with a line above it is inverted indicates that Input is "closed"

Note: Whenever possible use a NC type switch or sensor for CNC applications

Observing Outputs



Manually interacting with Input and Outputs

Inverting Inputs

A useful tool in the PLC diagnostic screen to employ while testing and setting things up is the ability to manually "invert" an input directly and immediately. Move the mouse (or use the arrow keys) to the input number to invert, and press <CTRL>, <ALT> and <i> at the same time. Press <CTRL>, <ALT> and <i> again at the same time to cycle the input from inverted state to not inverted. A mouse double click can also be used to invert or un-invert an input.

See this in action in the PLC Diagnostic App Video: https://youtu.be/FGgJ56p4M5Y

A white line will appear above an input that has been inverted either manually or by the Wizard. Any input can be manually inverted whether it has been assigned a PLC function or not.

Manually inverting an input is useful when first setting up a CNC control. For instance, when and input is configured in the Wizard but is not actually wired up to the CNC control, the integrator can use the mouse or the hot keys <CTRL ALT i> to invert that input so the control thinks the input is wired up and is in its happy state therefore "bypassing" this function or think of it as tricking the PLC into thinking the switch or sensor is connected and activated.

This tool can also be used if the switch or sensor is wired up and you wish to defeat it or exercise the PLC logic without actuating the physical switch to simulate switch activation.



Inverting an input in this manner is commonly used as a debug tool when initially configuring inputs however, the Wizard will set the input inversions properly depending on the NC (normally open) or NO (normally closed) selection made for that particular input. Be sure to return the input to its previous state when the input has been properly wired and configured with the Wizard for normal operation.

Manually interacting with Outputs

Another useful tool in the PLC Diagnostic App to use while testing and setting things up is ability to manually activate or deactivate an output.

Any output can be manually activated or deactivated whether it has been assigned a PLC function or not.

Warning: Be careful, if there is high power equipment connected to the CNC control that equipment will be activated when using the PLC Diagnostic App to manually energize an output.

Move the cursor to the output number to activate, and double click or press <CTRL>, <ALT> and <f> at the same time and the output activates.

Press <CTRL>, <ALT> and <f> again at the same time and the output deactivates.

Press <CTRL>, <ALT> and <f> again at the same time and the output returns to the normal programmed state.

A white line will appear below an Output that has been manually manipulated.



For instance if it is desired to test an output that controls a Dust Foot attachment on a CNC router to see if the output has been wired properly to the corresponding air solenoid, move the cursor to the output number that has been assigned the Dust Foot function, in the case below Output 6,

and double click or press <CTRL>, <ALT> and <f> at the same time and the output activates.



Double click again, or press <CTRL>, <ALT> and <f> at the same time and the output deactivates,

CNC12 PLC Diagnostic Screen	– 🗆 X
Simplified Input / Output PLC Diagnostics OUT6 : DustFootActivate	
Acorn On Board INPUTS 1-8 1 2 3 4 5 6 7 8	
Acorn On Board OUTPUTS 1-8 1 2 3 4 5 6 7 8 • • • • • • • • • • •	
 Alt i > Open PLC Diagnostics press again to close PLC diagnostics. CTRL Alt i > to invert input open or closed. CTRL Alt f > three step cycle to force an outp CTRL Alt o > Options Menu. CTRL Alt h > for Help 	ut: ON, OFF, or normal.

Press <CTRL>, <ALT> and <f> again at the same time and the output returns to the normal programmed state.

Be sure to return the output to its normal state (no white line) for normal CNC control operation.

There are two PLC diagnostic tools available with CNC12. The simplified and the original.

The Original looks like this and displays additional information compared to the simplified version.

wo X	CS #1 (G54	4) Curr	ent Positior	n (Inches)		Job Name Tool:	e: NO_JOB_ TH			+	AUTO SPINDLE MAN	N		Acorn	CNO
					•	Spindle:				100%	C	SET WCS XY0	SET WCS Z0	Auto Z to PLATE	PARK
Y						335 Emer	gency stop re	eleased				Laser Set XY	M55	GOTO WCS XY0	LIMIT SWITCH DEFEAT
Ζ						406 Emer	gency stop de	etected		0		M58		Laser Check X0Y0 ()	RESET HOME
										0"<	AUTO	DUST Collector	Hold Down VAC	Air Blow	1
				3 Input	te 4	Press C		to start job		RAPID		x1	x10	x100	MPG
1234	15678901 •••••••	23456789	01234567	8901234	56789012	3456789	01234567	8901234567	89012345678	9 0	4th+		Y+		Z+
1234		23456789	01234567	8901234	56789012	3456789	01234567	8901234567	89012345678	9 0 ••		x-		X+	
1234	15678901	23456789	01234567	8901234	56789012	3456789	01234567	8901234567	89012345678	9 0	4th-		Y -		z.
1234	15678901	23456789	01234567	8901234		3456789	01234567	8901234567	89012345678	90	•Ò•	SINGLE BLOCK	TOOL CHECK	FEED HOLD	
W01=+ W06=+	000000000000000000000000000000000000000	W02= W07=	+00000000000	W03= W08=	=+00000000000) WC)4=+00000000)9=+000000000	00 W05= 00 W10=	+0000000000 +0000000000	.12		_	FC	EEDRAT	E
PLC R PLC F	un Time (ms ast Stage T:) : 0 ime (ms): 0	.297235 .008746	Max: Max:	0.420433 0.016995	Mi: Mi:	n: 0.290388 n: 0.008368	Avg : Avg :	0.299340 0.008790		RESET	r	-	100%	+
											PRESS TO RESET		25%	50%	75%
	Setup	Load	MDI		CAM	Edit	Utility		Shut Down		OK			VCP	Push to
	F1	F2	F3		F5	F6	F 7		F10		511				

The simplified PLC Diagnostic App looks like this and is the default selection for Acorn and AcornSix.

	CS #1 (G54	(G54) Current Position (Inches) Job Name: NO_JOB_LOADED.cnc Tool: TH									+	AUTO SPINDLE MAN	N		Acorn	CNC
					•	Feedrate Spindle:	: 100% 0.0	0 ipm 0 A			100%	M3	SET WCS XY0	SET WCS Z0	Auto Z to PLATE	PARK
Y						335 Emer	aency stop re	lessed			-		Laser Set XY	M55	GOTO WCS XY0	LIMIT SWITCH DEFEAT
7						406 Emer	gency stop de	etected			0		M58	Laser	Laser Check X0Y0 ()	RESET HOME
					-						-0	AUTO	DUST Collector	Hold Down VAC	Air Blow	
						Press C	YCLE START	to start job			RAPID		x1	x10	×100	MPG
	CN	C12 PLC Diagnostic Sci	W	arning: Ma	chine Hom	ne Position	Not Set	- 🗆 X				4th+		Y+		Z+
		Simplif	ied Input / Ou	tput PLC Diagr	ostics INP1	: HomeAll							x-		X +	
		Acc 1 2	orn On Board INPUTS 3 4 5 6	51-8 78								4th-		Y -		z.
Mac X	hine Co +(Aco 1 2	rn On Board OUTPU1 3 4 5 6	rs 1-8 78								٠Ŏ٠	SINGLE	CHECK	FEED	
Y z	+(< Alt i >	Open PLC Diagnos	tics press again to o	lose PLC diagnost	ics.								C	EEDRAT VERRIDI 100%	E
Z	+(< CTRL # < CTRL #	Alt i > to invert inpu Alt o > Options Mei	it open of closed. < nu. < CTRL Alt h > 1	CTRL Alt f > three for Help	e step cycle to force	e an output: ON, OF	F, or normal.	MPU 38D2694D64EF om Router v4 9	12 SYSTEM ID -0406180825 9 BETA, Rev 6		RESE		-	100%	+
									ACORN	Shut		PRESS TO RESET		25%	50%	75%
	Setup F1	Load F2	MDI F3		CAM F5	Edit F6	Utility F7			Down F10		OK			VCP OPTIONS	Push to FREE

Controls for which one is the default application are found in the Acorn and AcornSix Wizard under "Preferences", "CNC Control"

Primary System	CNC Control Preference	-05
- Axis Drive Type		
 Input Definitions 	CNC12 Configuration Many parsword	Vec
Output Definitions	CNC12 Configuration Menu password	Yes
Axis	Display Distance To Go	Yes
- Configuration	Display Machine Coordinates	Yes
 Homing and Travel 	Display DRO Decimal Precision	
 Axes Pairing 	Display Dio Decinal recision	4 *
- Advanced	Display Active G&M Codes	No 🗸
pindle	Feedrate Override: Maximum percentage	100
Spindle #1	recurate overhae. maximum percentage	
– Rigid Tapping	Feedrate Override: Minimum percentage to invoke FEED	0
PWM Setup	HOLD	
	"Clean Filter" reminder message frequency in days.	0
ouch Devices	(default is OFF = 0)	
- Probe	Run Time Graphics on start up	Yes
└ Tool Touch Off	Remember Last G Code program after restart	No
Control Peripheral		
	Allow CYCLE START in Run Menu and Graph Menu	Yes
Wireless MPG	Display Keyboard Jogging Legend on Alt+J press	Yes
	Part G code Preview on Job Load	Yes
JB25 Connector	PopupPins Deactivate on Cycle Start	No
- Mapping		
TC	Disable Worklight on Startup	No
	Keyboard Jogging: Enter key = Cycle Start	No
- AIC Setup	USP,#Keyboard Jooging active on CNC12 studies	No
Preferences	Enable Simple DI C Diagnostic as default	Ves
	Enable Simple PLC Diagnostic as default	
	Force Rehoming After Estop condition	No

Which PLC Diagnostic tool to use can also be selected using Parameter 422 in the CNC configuration parameter menu.

P422 = 0 = use Simplified PLC Diagnostic App

P422 = 1 = use Advanced PLC Diagnostic menu

		Machii	ne Pa	rameters P340 -	P439				+		W		, Jean	ANA
340	0.0000 360	4000.0000	380	0.0000	400	1.0000	420	0.0000		MAN	Ť			
341	0.0000 361	4000.0000	381	54.0000	401	1.0000	421	0.0000	100%		SET	SET	Auto Z	PARK
342	0.0000 362	4000.0000	382	55.0000	402	0.0000	422	0.0000	100%		XYO	ZO	PLATE	TANK
343	0.0000 363	4000.0000	383	0.0000	403	0.0000	423	0.0000			Laser		бото	LIMIT
344	0.0000 364	4000.0000	384	0.0000	404	0.0000	424	0.0000		M 4	Set XY	M55	WCS XY0	SWITCH DEFEAT
345	1.7500 365	250.0000	385	0.0000	405	0.0000	425	0.0000					Lasor	
346	1.7500 366	2.0000	386	0.0000	406	0.0000	426	0.0000	0		M58	Laser	Check	RESET HOME
347	1.7500 367	2.0000	387	0.0000	407	0.0000	427	0.0000					XOYO	
348	15.0000 368	0.0000	388	0.0000	408	0.0000	428	0.0000		AUTO	DUST	Hold Down	Air	×-
349	100.0000 369	75.0000	389	0.0000	409	0.0000	429	0.0000		MAN	Collector	VAC	BIOW	
350	100.0000 370	0.0000	390	0.0000	410	1.0000	430	1.0000	RAPID	INCR		v10	×100	MPG
351	0.0000 371	0.0000	391	1000.0000	411	0.0000	431	0.0000	OVER	CONT	X1	XIU	X100	
352	100.0000 372	0.0000	392	0.0000	412	0.0000	432	0.0000						
353	400.0000 373	0.0000	393	0.1000	413	0.0000	433	0.0000		4th+		Y+		Z+
354	0.0000 374	255.0000	394	0.1000	414	0.0000	434	0.0000						
355	100.0000 375	4000.0000	395	30.0000	415	0.0000	435	0.0000			x –		X +	
356	400.0000 376	1.0000	396	30.0000	416	3.0000	436	0.0000				~		
357	4000.0000 377	0.0000	397	0.2500	417	1.0000	437	0.0000		4th-		Υ.		Z -
358	4000.0000 378	0.0000	398	1.0000	418	0.0000	438	0.0000				\sim		
359	4000.0000 379	0.0000	399	0.5000	419	0.0000	439	0.0000			SINGLE	TOOL	FEED	
Simplifi	ed PLC Diagnositic	S	1	N		N				P	BLOCK	CHECK	HOLD	
0 = Sim $1 = Adv$	plified anced											FC	EEDRAT VERRIDI 100%	E
										RESET		-	100%	+
<u> </u>					Prov	Novt				PRESS TO RESET		25%	50%	75%
X					Table	Table		Save					VCP	Push
Esc					F7	F8		F10		OK			OPTIONS	FREE