

Operator's Manual

PerfectPoint™





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THANK YOU FOR SELECTING A QUALITY PRODUCT BY LINCOLN ELECTRIC.

PLEASE EXAMINE CARTON AND EQUIPMENT FOR DAMAGE IMMEDIATELY

When this equipment is shipped, title passes to the purchaser upon receipt by the carrier. Consequently, claims for material damaged in shipment must be made by the purchaser against the transportation company at the time the shipment is received.

SAFETY DEPENDS ON YOU

Lincoln arc welding and cutting equipment is designed and built with safety in mind. However, your overall safety can be increased by proper installation ... and thoughtful operation on your part. DO NOT INSTALL, OPERATE OR REPAIR THIS EQUIPMENT WITHOUT READING THIS MANUAL AND THE SAFETY PRECAUTIONS CONTAINED THROUGHOUT. And, most importantly, think before you act and be careful.

\Lambda WARNING

This statement appears where the information must be followed exactly to avoid serious personal injury or loss of life.

This statement appears where the information must be followed to avoid minor personal injury or damage to this equipment.

KEEP YOUR HEAD OUT OF THE FUMES.

DON'T get too close to the arc. Use corrective lenses if necessary to stay a reasonable distance away from the arc.

READ and obey the Safety Data Sheet (SDS) and the warning label that appears on all containers of welding materials.

USE ENOUGH VENTILATION or exhaust at the arc, or both, to

keep the fumes and gases from your breathing zone and the general area.

IN A LARGE ROOM OR OUTDOORS, natural ventilation may be adequate if you keep your head out of the fumes (See below).

USE NATURAL DRAFTS or fans to keep the fumes away from your face.

If you develop unusual symptoms, see your supervisor. Perhaps the welding atmosphere and ventilation system should be checked.



WEAR CORRECT EYE, EAR & BODY PROTECTION

PROTECT your eyes and face with welding helmet properly fitted and with proper grade of filter plate (See ANSI Z49.1).

PROTECT your body from welding spatter and arc flash with protective clothing including woolen clothing, flame-proof apron and gloves, leather leggings, and high boots.

PROTECT others from splatter, flash, and glare with protective screens or barriers.

IN SOME AREAS, protection from noise may be appropriate.

BE SURE protective equipment is in good condition.

Also, wear safety glasses in work area AT ALL TIMES.



SPECIAL SITUATIONS

DO NOT WELD OR CUT containers or materials which previously had been in contact with hazardous substances unless they are properly cleaned. This is extremely dangerous.

DO NOT WELD OR CUT painted or plated parts unless special precautions with ventilation have been taken. They can release highly toxic fumes or gases.

Additional precautionary measures

PROTECT compressed gas cylinders from excessive heat, mechanical shocks, and arcs; fasten cylinders so they cannot fall.

BE SURE cylinders are never grounded or part of an electrical circuit.

REMOVE all potential fire hazards from welding area.

ALWAYS HAVE FIRE FIGHTING EQUIPMENT READY FOR IMMEDIATE USE AND KNOW HOW TO USE IT.









SECTION A: WARNINGS



CALIFORNIA PROPOSITION 65 WARNINGS

WARNING: Breathing diesel engine exhaust exposes you to chemicals known to the State of California to cause cancer and birth defects, or other reproductive harm.

- Always start and operate the engine in a well-ventilated area.
- If in an exposed area, vent the exhaust to the outside.
- Do not modify or tamper with the exhaust system.
- Do not idle the engine except as necessary.

For more information go to www.P65 warnings.ca.gov/diesel

WARNING: This product, when used for welding or cutting, produces fumes or gases which contain chemicals known to the State of California to cause birth defects and, in some cases, cancer. (California Health & Safety Code § 25249.5 <u>et seq.</u>)

WARNING: Cancer and Reproductive Harm www.P65warnings.ca.gov

ARC WELDING CAN BE HAZARDOUS. PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH. KEEP CHILDREN AWAY. PACEMAKER WEARERS SHOULD CONSULT WITH THEIR DOCTOR BEFORE OPERATING.

Read and understand the following safety highlights. For additional safety information, it is strongly recommended that you purchase a copy of "Safety in Welding & Cutting -ANSI Standard Z49.1" from the American Welding Society, P.O. Box 351040, Miami, Florida 33135 or CSA Standard W117.2. A Free copy of "Arc Welding Safety" booklet E205 is available from the Lincoln Electric Company, 22801 St. Clair Avenue, Cleveland, Ohio 44117-1199.

BE SURE THAT ALL INSTALLATION, OPERATION, MAINTENANCE AND REPAIR PROCEDURES ARE PERFORMED ONLY BY QUALIFIED INDIVIDUALS.



1.a. Turn the engine off before troubleshooting and maintenance work unless the maintenance work requires it to be running.



1.b. Do not add the fuel near an open flame welding arc or when the engine is running. Stop the engine and allow it to cool before refueling to prevent spilled fuel from vaporizing on contact with hot engine parts and igniting. Do not spill fuel when filling tank. If fuel is spilled, wipe it



up and do not start engine until fumes have been eliminated.

1.c. Keep all equipment safety guards, covers and devices in position and in good repair. Keep hands, hair, clothing and tools away from V-belts, gears, fans and all other moving parts when starting, operating or repairing equipment.



- 1.d. In some cases it may be necessary to remove safety guards to perform required maintenance. Remove guards only when necessary and replace them when the maintenance requiring their removal is complete. Always use the greatest care when working near moving parts.
- 1.e. Do not put your hands near the engine fan. Do not attempt to override the governor or idler by pushing on the throttle control rods while the engine is running.
- 1.f. To prevent accidentally starting gasoline engines while turning the engine or welding generator during maintenance work, disconnect the spark plug wires, distributor cap or magneto wire as appropriate.
- 1.g. To avoid scalding, do not remove the radiator pressure cap when the engine is hot.



- 1.h. Using a generator indoors CAN KILL YOU IN MINUTES.
- 1.i. Generator exhaust contains carbon monoxide. This is a poison you cannot see or smell.
- 1.j. NEVER use inside a home or garage, EVEN IF doors and windows are open.
- 1.k. Only use OUTSIDE and far away from windows, doors and vents.
- 1.I. Avoid other generator hazards. READ MANUAL BEFORE USE.



- 2.a. Electric current flowing through any conductor causes localized Electric and Magnetic Fields (EMF). Welding current creates EMF fields around welding cables and welding machines
- 2.b. EMF fields may interfere with some pacemakers, and welders having a pacemaker should consult their physician before welding.
- 2.c. Exposure to EMF fields in welding may have other health effects which are now not known.
- 2.d. All welders should use the following procedures in order to minimize exposure to EMF fields from the welding circuit:
 - 2.d.1. Route the electrode and work cables together Secure them with tape when possible.
 - 2.d.2. Never coil the electrode lead around your body.
 - 2.d.3. Do not place your body between the electrode and work cables. If the electrode cable is on your right side, the work cable should also be on your right side.
 - 2.d.4. Connect the work cable to the workpiece as close as possible to the area being welded.
 - 2.d.5. Do not work next to welding power source.







- 3.a. The electrode and work (or ground) circuits are electrically "hot" when the welder is on. Do not touch these "hot" parts with your bare skin or wet clothing. Wear dry, hole-free gloves to insulate hands.
- 3.b. Insulate yourself from work and ground using dry insulation. Make certain the insulation is large enough to cover your full area of physical contact with work and ground.

In addition to the normal safety precautions, if welding must be performed under electrically hazardous conditions (in damp locations or while wearing wet clothing; on metal structures such as floors, gratings or scaffolds; when in cramped positions such as sitting, kneeling or lying, if there is a high risk of unavoidable or accidental contact with the workpiece or ground) use the following equipment:

- Semiautomatic DC Constant Voltage (Wire) Welder.
- DC Manual (Stick) Welder.
- AC Welder with Reduced Voltage Control.
- 3.c. In semiautomatic or automatic wire welding, the electrode, electrode reel, welding head, nozzle or semiautomatic welding gun are also electrically "hot".
- 3.d. Always be sure the work cable makes a good electrical connection with the metal being welded. The connection should be as close as possible to the area being welded.
- 3.e. Ground the work or metal to be welded to a good electrical (earth) ground.
- 3.f. Maintain the electrode holder, work clamp, welding cable and welding machine in good, safe operating condition. Replace damaged insulation.
- 3.g. Never dip the electrode in water for cooling.
- 3.h. Never simultaneously touch electrically "hot" parts of electrode holders connected to two welders because voltage between the two can be the total of the open circuit voltage of both welders.
- 3.i. When working above floor level, use a safety belt to protect yourself from a fall should you get a shock.
- 3.j. Also see Items 6.c. and 8.



ARC RAYS CAN BURN.



- 4.a. Use a shield with the proper filter and cover plates to protect your eyes from sparks and the rays of the arc when welding or observing open arc welding. Headshield and filter lens should conform to ANSI Z87. I standards.
- 4.b. Use suitable clothing made from durable flame-resistant material to protect your skin and that of your helpers from the arc rays.
- 4.c. Protect other nearby personnel with suitable, non-flammable screening and/or warn them not to watch the arc nor expose themselves to the arc rays or to hot spatter or metal.

FUMES AND GASES CAN BE DANGEROUS.



- 5.a. Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. When welding, keep your head out of the fume. Use enough ventilation and/or exhaust at the arc to keep fumes and gases away from the breathing zone. When welding hardfacing (see instructions on container or SDS) or on lead or cadmium plated steel and other metals or coatings which produce highly toxic fumes, keep exposure as low as possible and within applicable OSHA PEL and ACGIH TLV limits using local exhaust or mechanical ventilation unless exposure assessments indicate otherwise. In confined spaces or in some circumstances, outdoors, a respirator may also be required. Additional precautions are also required when welding on galvanized steel.
- 5. b. The operation of welding fume control equipment is affected by various factors including proper use and positioning of the equipment, maintenance of the equipment and the specific welding procedure and application involved. Worker exposure level should be checked upon installation and periodically thereafter to be certain it is within applicable OSHA PEL and ACGIH TLV limits.
- 5.c. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.
- 5.d. Shielding gases used for arc welding can displace air and cause injury or death. Always use enough ventilation, especially in confined areas, to insure breathing air is safe.
- 5.e. Read and understand the manufacturer's instructions for this equipment and the consumables to be used, including the Safety Data Sheet (SDS) and follow your employer's safety practices. SDS forms are available from your welding distributor or from the manufacturer.
- 5.f. Also see item 1.j.





WELDING AND CUTTING SPARKS CAN CAUSE FIRE OR EXPLOSION.



- 6.a. Remove fire hazards from the welding area. If this is not possible, cover them to prevent the welding sparks from starting a fire. Remember that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas. Avoid welding near hydraulic lines. Have a fire extinguisher readily available.
- 6.b. Where compressed gases are to be used at the job site, special precautions should be used to prevent hazardous situations. Refer to "Safety in Welding and Cutting" (ANSI Standard Z49.1) and the operating information for the equipment being used.
- 6.c. When not welding, make certain no part of the electrode circuit is touching the work or ground. Accidental contact can cause overheating and create a fire hazard.
- 6.d. Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been "cleaned". For information, purchase "Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances", AWS F4.1 from the American Welding Society (see address above).
- 6.e. Vent hollow castings or containers before heating, cutting or welding. They may explode.
- 6.f. Sparks and spatter are thrown from the welding arc. Wear oil free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes and a cap over your hair. Wear ear plugs when welding out of position or in confined places. Always wear safety glasses with side shields when in a welding area.
- 6.g. Connect the work cable to the work as close to the welding area as practical. Work cables connected to the building framework or other locations away from the welding area increase the possibility of the welding current passing through lifting chains, crane cables or other alternate circuits. This can create fire hazards or overheat lifting chains or cables until they fail.
- 6.h. Also see item 1.b.
- 6.I. Read and follow NFPA 51B "Standard for Fire Prevention During Welding, Cutting and Other Hot Work", available from NFPA, 1 Batterymarch Park, PO box 9101, Quincy, MA 022690-9101.
- 6.j. Do not use a welding power source for pipe thawing.

CYLINDER MAY EXPLODE IF DAMAGED.

7.a. Use only compressed gas cylinders containing the correct shielding gas for the process used and properly operating regulators designed for the gas and pressure used. All hoses, fittings, etc. should be suitable for the application and maintained in good condition.



- 7.b. Always keep cylinders in an upright position securely chained to an undercarriage or fixed support.
- 7.c. Cylinders should be located:
 - Away from areas where they may be struck or subjected to physical damage.
 - A safe distance from arc welding or cutting operations and any other source of heat, sparks, or flame.
- 7.d. Never allow the electrode, electrode holder or any other electrically "hot" parts to touch a cylinder.
- 7.e. Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.
- 7.f. Valve protection caps should always be in place and hand tight except when the cylinder is in use or connected for use.
- 7.g. Read and follow the instructions on compressed gas cylinders, associated equipment, and CGA publication P-I, "Precautions for Safe Handling of Compressed Gases in Cylinders," available from the Compressed Gas Association, 14501 George Carter Way Chantilly, VA 20151.

FOR ELECTRICALLY POWERED EQUIPMENT.

- 8.a. Turn off input power using the disconnect switch at the fuse box before working on the equipment.
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- 8.b. Install equipment in accordance with the U.S. National Electrical Code, all local codes and the manufacturer's recommendations.
- 8.c. Ground the equipment in accordance with the U.S. National Electrical Code and the manufacturer's recommendations.

Refer to http://www.lincolnelectric.com/safety for additional safety information.



ELECTROMAGNETIC COMPATIBILITY (EMC)

CONFORMANCE

Products displaying the CE mark are in conformity with European Community Council Directive of 15 Dec 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility, 2014/30/EU. It was manufactured in conformity with a national standard that implements a harmonized standard: EN 60974-10 Electromagnetic Compatibility (EMC) Product Standard for Arc Welding Equipment. It is for use with other Lincoln Electric equipment. It is designed for industrial and professional use.

INTRODUCTION

All electrical equipment generates small amounts of electromagnetic emission. Electrical emission may be transmitted through power lines or radiated through space, similar to a radio transmitter. When emissions are received by other equipment, electrical interference may result. Electrical emissions may affect many kinds of electrical equipment; other nearby welding equipment, radio and TV reception, numerical controlled machines, telephone systems, computers, etc.

Warning: This Class A equipment is not intended for use in residential locations where the electrical power is provided by the public low-voltage supply system. There may be potential difficulties in ensuring electro-magnetic compatibility in those locations, due to conducted as well as radiated disturbances.

This machine has been designed to operate in an industrial area. The operator must install and operate this equipment as described in this manual. If any electromagnetic disturbances are detected the operator must put in place corrective actions to eliminate these disturbances with, if necessary, assistance from Lincoln Electric. This equipment does not comply with IEC 61000-3-12. If it is connected to a public low-voltage system, it is responsibility of the installer or user of the equipment to ensure, by consultation with the distribution network operator if necessary, that the equipment may be connected.

INSTALLATION AND USE

The user is responsible for installing and using the welding equipment according to the manufacturer's instructions.

If electromagnetic disturbances are detected then it shall be the responsibility of the user of the welding equipment to resolve the situation with the technical assistance of the manufacturer. In some cases this remedial action may be as simple as earthing (grounding) the welding circuit, see Note. In other cases it could involve constructing an electromagnetic screen enclosing the power source and the work complete with associated input filters. In all cases electromagnetic disturbances must be reduced to the point where they are no longer troublesome.

Note: The welding circuit may or may not be earthed for safety reasons. Follow your local and national standards for installation and use. Changing the earthing arrangements should only be authorized by a person who is competent to assess whether the changes will increase the risk of injury, e.g., by allowing parallel welding current return paths which may damage the earth circuits of other equipment.

ASSESSMENT OF AREA

Before installing welding equipment the user shall make an assessment of potential electromagnetic problems in the surrounding area. The following shall be taken into account:

- a) other supply cables, control cables, signaling and telephone cables; above, below and adjacent to the welding equipment;
- b) radio and television transmitters and receivers;
- c) computer and other control equipment;
- d) safety critical equipment, e.g., guarding of industrial equipment;
- e) the health of the people around, e.g., the use of pacemakers and hearing aids;
- f) equipment used for calibration or measurement;
- g) the immunity of other equipment in the environment. The user shall ensure that other equipment being used in the environment is compatible. This may require additional protection measures;
- h) the time of day that welding or other activities are to be carried out.

The size of the surrounding area to be considered will depend on the structure of the building and other activities that are taking place. The surrounding area may extend beyond the boundaries of the premises.

METHODS OF REDUCING EMISSIONS

Public Supply System

Welding equipment should be connected to the public supply system according to the manufacturer's recommendations. If interference occurs, it may be necessary to take additional precautions such as filtering of the system. Consideration should be given to shielding the supply cable of permanently installed welding equipment, in metallic conduit or equivalent. Shielding should be electrically continuous throughout its length. The shielding should be connected to the welding power source so that good electrical contact is maintained between the conduit and the welding power source enclosure.



Maintenance of the Welding Equipment

The welding equipment should be routinely maintained according to the manufacturer's recommendations. All access and service doors and covers should be closed and properly fastened when the welding equipment is in operation. The welding equipment should not be modified in any way except for those changes and adjustments covered in the manufacturer's instructions. In particular, the spark gaps of arc striking and stabilizing devices should be adjusted and maintained according to the manufacturer's recommendations.

Welding Cables

The welding cables should be kept as short as possible and should be positioned close together, running at or close to the foor level.

Equipotential Bonding

Bonding of all metallic components in the welding installation and adjacent to it should be considered. However, metallic components bonded to the work piece will increase the risk that the operator could receive a shock by touching these metallic components and the electrode at the same time. The operator should be insulated from all such bonded metallic components.

Earthing of the Workpiece

Where the workpiece is not bonded to earth for electrical safety, nor connected to earth because of its size and position, e.g., ship's hull or building steelwork, a connection bonding the workpiece to earth may reduce emissions in some, but not all instances. Care should be taken to prevent the earthing of the workpiece increasing the risk of injury to users, or damage to other electrical equipment. Where necessary, the connection of the workpiece to earth should be made by a direct connection to the workpiece, but in some countries where direct connection is not permitted, the bonding should be achieved by suitable capacitance, selected according to national regulations.

Screening and Shielding

Selective screening and shielding of other cables and equipment in the surrounding area may alleviate problems of interference. Screening of the entire welding installation may be considered for special applications.



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Section 1 INTRODUCTION

OVERVIEW

The PerfectPoint solution is a tool to automatically define and update the tool center point (TCP) for whichever type of torch used on the robot.

This manual explains the basics of when and how to use the PerfectPoint. It can be used as a reference and a description of how to use an option.

Operating this solution requires the base knowledge of industrial robot terminologies, and the differences of operating the robot in Auto and Manual mode.

LIMITATIONS

PerfectPoint can be used with a variety of torches, with some limitations:

- The PerfectPoint device needs to be connected to the controller through an I/O board.
- For accurate results and better outcome, the robot is expected to be well calibrated and mastered.
- It must be noted that the search is done on the Gascup, not the wire sticking out.
- The Gascup needs to be installed and cylindrical.
- Karel option is required on the controller.
- The tool must have adequate clearance to allow the program to complete all movements involved with the process safely.
- Any program using the PerfectPoint must have a stack of at least 4000.
- The digital input is considered to be always OFF when the beam is not interrupted.
- External Axis are not supported.
- Gascups with stickout contact tips are not supported.
- The PerfectPoint supports R-30iB Plus controller or newer.



Section 2 INSTALLATION

HARDWARE CONFIGURATION

After connecting the device to the controller, make sure that the device is recognized and the digital input is set to the expected state.

Follow these steps to confirm the state of the digital input used:

- Click on the "MENU" button on the Teach Pendant.
- Select option 5 "I/O".
- Click "F1 Type".
- · Select "Digital".
- Click "F3 IN/OUT".
- Navigate to the digital input used when setting up the device.
- Confirm that the input is showing "OFF" when the beam is not interrupted, and "ON" when the beam is broken.
- If the digital input was not properly configured, click "F5 Next".
- Click "F4 DETAIL".
- Navigate to "Polarity" and set it to the other.

FANUC I/0 WIRING INSTALLATION

Connect the female end of the supplied (IFM Efector EVC003) cable to the male end of the cable connected to on the PerfectPoint Measurement Device. The pigtail end of the supplied cable will attach to the I/O board within the robot controller.



Figure 2-1

PerfectPoint Wiring Schematic

PerfectPoint Measurement Device Schematic



Figure 2-2

FANUC Peripheral Device Connection

Connect the 3 wires from the pigtail end of the supplied cable to the FANUC Terminal Conversion Board (I/O Board) on terminal connector.

- Brown 24V DC
- Blue 0V DC
- Black Digital Input



LICENSE GENERATION AND INSTALLATION

You need a USB drive with the following files in its root directory (files to be provided by Lincoln Electric Automation Technical Support Team):

- GetRobotInfo.cm
- getinfo.pc
- Installation_License.cm
- install.pc

Obtain the robotinfo file by plugging the USB drive into the USB port in the robot controller. Navigate to the FILE > 1/1 Menu.

Set the active device to match the USB port you plugged the drive into; it could be either UD1 or UT1.

• [UTIL] > Set Device > USB Disk (UD1)/USB on TP (UT1)

FILE			1
	1/1	×	
TD:*.* 1 * 2 * 3 * 4 * 5 * 6 * 7 * 8 *	1 FROM Disk (FR:) 2 Backup (FRA:) 3 RAM Disk (RD:) 4 Mem Card (MC:) 5 Mem Device (MD:) 6 Console (CONS:)		
9 * 10 * 11 * Press DI	7 USB Disk (UD1:) 8 USB on TP (UT1:)		
	TYPE] [DIR] LOAD [BACKUP] [UT	IL]	>

Figure 2-3



Run the GetRobotInfo.cm script:

- From the "all files" line click on the GETROBOTINFO script.
- When prompted to execute the script, select 'YES'.
- You should see the "Robot info file created successfully!" message on the screen as shown below

FILE	FILE
UD1:*.* 3/38 1 COOPER_APP IPL 8401524 COOPER_A 2 GETINFO PC 1077 GETINFO 3 GETROBOTINFO CM 97 GETROBOT 4 INFOFILES <dir> INFOFILE 5 INSTALL PC 1225 INSTALL 6 INSTALL_LICENSE CM 100 INSTALL_ 7 * * (all files) 8 * KL (all KAREL source) 9 * CF (all command files) 10 * TX (all text files) 11 * LS (all KAREL listings)</dir>	Robot info file created successfully!
III [TYPE] [DIR] LOAD [BACKUP] [UTIL]	

Figure 2-4

License Generation

There should now be a folder called "INFOFILES" on the USB.

- In that folder there should be a file called "XXXXX.INF", where X is an alphanumeric character.
- Forward the XXXXXX.INF file to Technical Support for the generation of a Software License.

License Installation

- Create a new folder on the USB called "Licenses".
- Save the license file, provided to you, onto the same USB drive as the "Licenses" folder. If the file is not stored to this location, the license installer will not find it. There can be multiple license files in this folder, the installer will know which file to install.
- Insert the USB into the controller port again and navigate to the FILE > 1/1 Menu.
- Run the "INSTALL_LICENSE" script.
- You should see the "License was installed successfully!" message.



FILE	FILE
UD1:*.* 6/39 1 COOPER_APP IPL 8401524 2 GETINFO PC 1077 3 GETROBOTINFO CM 97 4 INFOFILES <dir> 5 INSTALL PC 1225 6 INSTALL LICENSE CM 100 7 LICENSES <dir> 8 * * (all files) 9 * KL (all KAREL source) 10 + CPE (chl karel source)</dir></dir>	COOPER_A GETINFO GETROBOT INFOFILE INSTALL LICENSES
10 * CF (all command files) 11 * TX (all text files)	
ITYPE] [DIR] LOAD [BACKUP]	

Figure 2-5

Lincoln Electric Custom Error Dictionary Installation

If you have the error dictionary installed already, this step can be skipped.

To install the error dictionary, contact Lincoln Electric Technical Support Support to provide you a folder called "LECO Errors Install Files.zip", and extract it to your USB drive.

- Transfer the USB drive to the controller and navigate to FILE > 1/1 menu.
- Set the active device to match the USB port you plugged the drive into; it could be either UD1 or UT1.
- Run "INSTALL_ERROR_DICT" script.
- You should see the "Execution is completed successfully" message.
- Once done, cycle power the controller.

FILE	FILE	
UD1:*.* 6/41 1 COOPER_APP IPL 8401524 2 GETINFO PC 1077 3 GETROBOTINFO CM 97 4 INFOFILES <dir> 5 INSTALL_ERROR_DICT CM 27 7 INSTALL_LICENSE CM 100 8 LECOERRS TX 25 9 LICENSES <dir></dir></dir>	UD1:*.* GETINFO GETROBOT INFOFILE INSTALL INSTALL_ LECOERRS LICENSES	6/41
II * KL (all KAREL source)	Execution is completed success:	Fully ок

Figure 2-6



SOFTWARE INSTALLATION

To install the software, extract the "PerfectPointVX.X.X.zip" in your USB drive, where X is a numerical value representing the version. Make sure all files are in the root directory of the USB drive.

Transfer the USB drive to the controller and use either the USB on the controller or the Teach Pendant.

Make sure the controller already has Lincoln Electric Custom Error Dictionary and the appropriate license for PerfectPoint.

Once done, follow these steps to install PerfectPoint Solution to your system:

- Click "MENU".
- Select "FILE".
- Select "FILE" again.
- Click "F5 UTIL".
- Select "Set Device".
- Choose the device where you inserted the USB drive.
- Navigate to "all files" and click "ENTER".
- Navigate to "INSTALL_PP" and click "ENTER".
- Click "F4 Yes".
- Wait for the execution to finish.
- Cycle power the robot for changes to take effect.

Next, you need to setup the back-logic part of the solution. Follow these steps to set up the back-logic:

- Click "MENU".
- Select "SETUP".
- Select "BG LOGIC".
- Navigate to an empty slot and click "F4 CHOICE".
- Navigate to "PerfectPoint_BG" and click "ENTER".
- Click "F2 RUN".



Section 3 USER GUIDE

OVERVIEW

The PerfectPoint Solution is designed as a set of call commands. User can call different programs using appropriate parameters in any other TP program to access the PerfectPoint or to modify different settings.

A good tool center point (TCP) can be verified by jogging the robot about the three axis; the robot should utilize its all axis to keep the TCP stationary. If the TCP has moved since the last calibration, an update will run and the robot will repeat the same movements done when computing the first time.

If the TCP has moved significantly, this indicates physical damage and requires adjustment before the program is able to compute a new TCP.

When implementing PerfectPoint for the first time or after a torch change, it is necessary to complete a PerfectPoint Setup.

DATA STORAGE

The PerfectPoint uses and creates several files in its memory to persist the custom data used while calibrating. For easy access, these files are stored in the FR memory under the directory "LE_PERFECTPOINT".

LE_PERFECTPOINT also stores the logs created for debugging with the Lincoln Electric[®] support team.

Another directory stored in FR memory is "LE_COMMON". It is critical that this directory remains untouched.

USING PERFECTPOINT

PerfectPoint Quick Run

The PerfectPoint comes with three pre-defined templates that the user can use to calibrate the TCP without the need to make any calls.

Select the template that corresponds with the operation you are trying to execute (PP_SETUP_GUIDE or PP_RAPIDCHECK _GUIDE), utilizing the points template (PP_SETUP_POINTS) for the points recording.



Recording the Reference Points

To be able to run PerfectPoint, reference points must be setup using the following steps:

- Click "SELECT" button on the teach pendant keypad.
- Navigate to "PP_SETUP_POINT" and click "ENTER".

This will display the screen shown below:



Figure 3-1

Recording Approach Point

From the three options navigate the cursor to the "Approach Point" line ensuing that the number "4" is highlighted in black. Once selected, the number 4 will be highlighted in black. Jog the robot to the location of the Approach Point (1). The ideal Approach Point will place the torch perpendicular to the opening of the device without breaking the laser beam. Once in place, record the Approach Point position by holding "SHIFT" and clicking "F5 – TOUCHUP". Once the point is recorded, an "@" symbol will be shown next to the point that was just recorded.





Figure 3-2



Recording OnBeam Point

From the three options, navigate the cursor to the "OnBeam Point" line ensuing that the number "5" is highlighted in black. Once selected, the number 5 will be highlighted in black. Now jog your robot to the location of the On-Beam Point (1). The ideal OnBeam Point will place the torch perpendicular to the beam, breaking the laser beam and as close as possible to the center of the device opening. The torch Gascup (not the wire) must break the path of the laser beam. Once in place, record the Approach Point position by holding "SHIFT" and clicking "F5 – TOUCHUP". Once the point is recorded, an "@" symbol will be shown next to the point that was just recorded.





Figure 3-3

Recording TruePoint Point

From the three options, navigate the cursor to the "TruePoint Point" line ensuing that the number "6" is highlighted in black. Once selected, the number 6 will be highlighted in black. Now jog your robot to the location of the OnBeam Point. The ideal OnBeam Point will place the torch perpendicular to the beam, breaking the laser beam and as close as possible to the center of the device opening. The torch Gascup (not the wire) must break the path of the laser beam. Once in place, record the Approach Point position by holding "SHIFT" and clicking "F5 – TOUCHUP". Once the point is recorded, an "@" symbol will be shown next to the point that was just recorded.





Figure 3-4



PerfectPoint Setup

Once the points are recorded, it will be possible to use the provided template guides to setup TCP using the following steps:

- Click "SELECT" button on the teach pendant keypad.
- Navigate to "PP_SETUP_GUIDE" and click "ENTER".

This will display the screen shown below:





Scroll to the last call as shown in the figure, and setup the tools' parameters using the following steps:

- Click on the parameter you wish to update. This will highlight the parameter in black as shown below.
- With the teach pendant turned on, enter the new value for the chosen parameter and click "ENTER".
- Repeat these step for Stickout, Signal number, and ToolFrame number.

Select the Stickout (mm) to define the stickout value of the wire. Note that this value is measured between the tip of the wire and the edge of the gascup.

Select the Signal number option to define the Digital Input number that the PerfectPoint measurement device is connected to and click "ENTER".

Select the Speed (mm/sec) option to define the motion speed in which the robot will move while



computing the TCP. The speed must have a value between 100 and 200.

Select the ToolFrame number to define the tool frame number to be associated with the installed torch. Enter the new value and click "ENTER". The selected tool frame will hold the values of the calculated TCP and will overwrite any previously stored values.

After setting all the parameters as needed, run the program to start the TCP Calibration process.



Figure 3-6

Upon completion, the calculated TCP values will be prompted along with max error and mean error. Click "ENTER" to terminate the program.



Figure 3-7



PerfectPoint RapidCheck

After running TCP Setup for a certain tool frame, TCP can be checked if it is still acceptable by performing a RapidCheck using the following steps:

- Click "SELECT" button on the teach pendant keypad.
- Navigate to "PP_RAPIDCHECK_GUIDE" and click "ENTER".

This will display the screen shown below:



Figure 3-8

Navigate to the last call and update the ToolFrame # parameter by clicking on it. With the teach pendant enabled, enter the new value and click "ENTER", then run the program.



PerfectPoint Stand-Alone

PerfectPoint Points Template Creation

The PerfectPoint utilizes three reference points for each tool used. These points are used to teach the program the relative location of the PerfectPoint device in reference to the used tool.

Using the FANUC teach pendant, set the reference points by accessing the "Select" interface, and navigate to the TP program "PP_POINTS" template. Click on "F1 – COPY" button and rename the TP Program (i.e. PP_POINTS_TORCH_1). If you can not see COPY in the soft options, click the "NEXT" button or ">" soft key.





Once done, select "ENTER" and touchup the points as described in *Recording the Reference Points on page 3-2*.



PerfectPoint Setup

The PerfectPoint Solution is designed to be run as a Stand-Alone Program or it can be called within a Welding Program that you have already created. Including PerfectPoint within a program allows the TCP Calibration process to run within a program at various intervals (i.e. run after every 100 completed parts).

- To run a TCP Calibration, call the "PERFECTPOINT_SETUP" in a TP program from Macro tab.
- To call a PerfectPoint from within a TP program, set the stack size of the program to 4000.

Access the TP program and follow these promts:

- NEXT
- F1- [INST]
- CALL
- CALL Program
- F2-Macro
- Select "PerfectPoint_Setup"
- ENTER

PP_SET	TUP_GUIDE
11: 12: 13: : : : : : : : : : : : : : : : : :	<pre>13/15 !Run TCP Setup CALL PERFECTPOINT_SETUP(Points File='PP_POINTS_CPY', Stickout (mm)=15,Default Motion, Default Gascup,Default Settings,Signal #=4, Speed (mm/sec)=75,ToolFrame # =10)</pre>
	CHANGE

Figure 3-10

Select the different settings that corresponds with the choices. To select the points, click on the option "Points File" and then click "F5 - CHANGE", the screen will be prompted. Click on "F5 – STRING" and enter the name of the copy program created earlier, then click "ENTER".



String select	×
1 MENUS	7/8
2 I/O SIGNALS	
3 TOOL	
4 WORK	1 Gascup,
5 POS	=2)
6 DEV	
7 PALT	
8next page	
	abc STRINGS

Figure 3-11

Select the Stickout (mm) option to define the length of the wire stickout in mm. Enter the new value and click "ENTER". Note that this value is measured from the tip of the wire to the edge of the gascup.

Select Motion, Gascup, and Settings options, then click "F4 – CHOICE" to choose one of the options displayed in the pop-up screen. To be able to use the custom options, first *See Advanced Settings on page 3-13*.

Select the Signal # option to define the Digital Input number connected to the device. Enter the value and click "ENTER".

Select the Speed (mm/sec) option to define the motion speed in which the robot will move while computing the TCP. The speed must have a value between 70 and 200.

Select the ToolFrame number to define the tool frame number to be associated with the installed torch. Enter the new value and click "ENTER". The selected tool frame will hold the values of the calculated TCP and will overwrite any previously stored values.

After setting all the parameters as needed, run the program to start the TCP Calibration process.

	Linco	oln	Electric	PerfectPoint	
Calibrating	TCP				
on ToolFram	le :	2			

Figure 3-12

This may take a few minutes, depending on the termination settings defined by the user in the settings. Upon completion, the calculated TCP values will be prompted, along with max error and mean error. Click "ENTER" to terminate the program.



```
Lincoln Electric PerfectPoint
V 1.0
Initial TCP has been computed
TCP:
-4.392 -.054 395.009
-179.988 -45.071 -.049
N U T, 0, 0, 0
Max Error = .05 Mean Error = .03
Press "ENTER" key to continue
```

Figure 3-13

PerfectPoint RapidCheck

After running TCP Setup for a certain tool frame, TCP can be checked if it is still acceptable by performing a RapidCheck.

You can run RapidCheck as a Stand-Alone Program, or as part of the previously created weld program.

- To call a RapidCheck from within a TP program, set the stack size of the program to 4000.
- To perform a RapidCheck, call the "PERFECTPOINT_RAPIDCHECK" in a TP program.

Access the TP program and follow these promts:

- NEXT
- F1-[INST]
- CALL
- CALL Program
- F2-Macro
- Select "PerfectPoint RapidCheck"
- Enter

Select MaxChange option, then click "F4 – CHOICE" to choose one of the options displayed in the pop-up screen. To be able to use the custom options, please *See Advanced Settings on page 3-13*.

Enter the number of the tool frame affected by clicking on the "ToolFrame" parameter. Enter the new value and click "ENTER".

"Confirm Update Threshold", this optional value must be less than the "Max Change From Setup TCP (mm)" entered when defining the MaxChange.

Set the "Confirm Update Threshold" value by clicking on the parameter, entering the new value, and clicking "ENTER". When this value is set to 0 it will be ignored.

This value is used to alert of any physical defect between the existing TCP and the last updated TCP. If the error between the two is more than "Confirm Update Threshold", then PerfectPoint alerts the user. This is to detect significant change between the last TCP and current TCP.





Figure 3-14

When running either RapidCheck, the screen in the figure below will be displayed:

Lincoln Electric PerfectPoint V 1.0.1 Performing TCP RapidCheck on ToolFrame : 10

Figure 3-15

When the RapidCheck call is run in Manual Mode, the offset values compared to the last calculated TCP will be displayed.

If the error in the offset is within the margin defined by the user, the program will just display the values and the error. Click "ENTER" to proceed.

However, if the values were not in the error margin, the software will display the values and ask the user whether to update the TCP or not.

In auto mode, the software will terminate if the values are within tolerance, or it will perform an update if the values were out of tolerance.



Figure 3-16

If in manual mode and option "1" is selected in this screen, the software will begin to perform a new full TCP Calibration process to update the values stored.





Figure 3-17

Upon completion, the new updated values for the selected tool frame will be displayed.



Figure 3-18

If the values were beyond the threshold entered in "Max Change From Setup TCP (mm)", the user will be informed that the torch has a physical defect and require a physical adjustment before being able to calculate a new TCP as shown below:



Figure 3-19



Advanced Settings

The user has the ability to create custom control calibration profiles. These include Motion, Gascup, Settings, and MaxChange.

Motion Settings

To setup a Custom Motion Settings for PerfectPoint, call the "PERFECTPOINT_DEFINE_MOTION" in a TP program from the Macro tab.

Access the TP program and follow these prompts:

- NEXT
- F1 [INST]
- CALL
- CALL Program
- F2 Macro
- Select "PerfectPoint_DEFINE_MOTION"
- ENTER





Following are the description of parameters needed to define a Custom Motion.



Custom Motion

The user can select from 10 different custom motions to setup.

Click on Custom # Motion and click "F4 - CHOICE". A pop-up screen will appear to select the number of the custom motion to setup as shown below:

1:	Custom1	Motion
2:	Custom2	Motion
3:	Custom3	Motion
4:	Custom4	Motion
5:	Custom5	Motion
6:	Custom6	Motion
7:	Custom7	Motion
8:	Custom8	Motion
9:	Custom9	Motion
10:	Custom1() Motion

Figure 3-21

Circle Radius

This option is used to define the radius of the circle the robot will create when performing TCP calibration inside the device opening.

The currently set value will be displayed next to this option in mm in the Define Motion Call.

To update this value, click on the number next to the option, enter the new value and click "ENTER".

The Default value is 35 and the High-Accuracy value is 35, the assigned value should be between 25 and 40.

Max Rotation Angle Around Beam

This option is used to define the maximum angle the robot will position the Gascup on either side of the PerfectPoint laser beam during the calibration process.

The currently set value will be displayed next to this option in degrees in the Define Motion.

To update this value, click on the number next to the option, enter the new value, and click "ENTER".

The Default value is 18 and the High-Accuracy value is 22.5. The entered value should be between 10 and 35.

Max Rotation Angle Around Tool

This option is used to define the maximum angle the robot will turn the Gascup about its center during the calibration process.

The currently set value will be displayed next to this option in degrees in the Define Motion Call.

To update this value, click on the number next to the option, enter the new value, and click "ENTER".

The Default value is 18 and the High-Accuracy value is 22.5. The entered value should be between 10 and 35.



Gascup Settings

To setup a Custom Gascup setting for PerfectPoint, call the "PERFECTPOINT_DEFINE_GASCUP" in a TP program from the Macro tab.

Access the TP program and follow these promtps:

- NEXT
- F1 [INST]
- CALL
- CALL Program
- F2 Macro
- Select "PerfectPoint_DEFINE_GASCUP"
- ENTER



Figure 3-22

Following are the description of parameters needed to define a Custom Gascup.



Custom Number Gascup

The user can select from 10 different Custom Gascups to setup.

Click on Custom # Gascup and click "F4 - CHOICE". A pop-up screen will appear to select the number of the custom Gascup to setup as shown below:

1:	Custom1	Gascup
2:	Custom2	Gascup
3:	Custom3	Gascup
4:	Custom4	Gascup
5:	Custom5	Gascup
6:	Custom6	Gascup
7:	Custom7	Gascup
8:	Custom8	Gascup
9:	Custom9	Gascup
10:	Custom1() Gascup



Lower Search Location

This option is used to define the location of the lower end (1) of the Gascup.

The currently set value will be displayed next to this option in mm in the Define Gascup Call.

To update this value, click on the number next to the option, enter the new value, and click "ENTER".

The Default value is 5 and the High-Accuracy value is 5. The entered value should be between 5 and 15.

Upper Search Location

This option is used to define the location of the upper end (2) of the Gascup.

The currently set value will be displayed next to this option in mm in the Define Gascup Call.

To update this value, click on the number next to the option, enter the new value, and click "ENTER".

The Default value is 75 and the High-Accuracy value is 90. The entered value should be between 50 and 90.



Figure 3-24



Settings

To setup a Custom Settings Profile for PerfectPoint, call the "PERFECTPOINT_DEFINE_SETTINGS" in a TP program from the Macro tab.

Access the TP program and follow these prompts:

- NEXT
- F1-[INST]
- CALL
- CALL Program
- F2-Macro
- Select "PerfectPoint_DEFINE_SETTINGS"
- ENTER

```
!Settings
CALL PERFECTPOINT_DEFINE_SETTINGS(
Custom1 Settings,Measure Speed(mm/sec)=10,
Max Postition Error(mm)=.2,
Max Orientation Error(deg)=.1,Max Iterations=15)
```

Figure 3-25

Below are the description of parameters needed to define a Custom Termination.

Custom Settings

The user can select from 10 different Custom Settings to setup.

Click on Custom Settings and click "F4 - CHOICE". A pop-up screen will appear to select the number of the Custom Settings to setup as shown below:

1:	Custom1	Settings	
2:	Custom2	Settings	
3:	Custom3	Settings	
4:	Custom4	Settings	
5:	Custom5	Settings	
6:	Custom6	Settings	
7:	Custom7	Settings	
8:	Custom8	Settings	
9:	Custom9	Settings	
10:	Custom1() Settings	

Figure 3-26



Measure Speed (mm/sec)

This option is used to define and update the speed in which the robot will move while measuring the dimensions of the gascup on the device.

The currently set value will be displayed next to this option in mm in the Define Settings Call.

To update this value, click on the number next to the option, enter the new value, and click "ENTER".

The Default value is 7 and the High-Accuracy value is 5. The entered value should be between 5 and 15.

Max Position Error (mm)

This option is used to define and update the accepted error in position between two calculated TCP values to terminate the calibration process.

The currently set value will be displayed next to this option in mm in the Define Settings Call.

To update this value, click on the number next to the option, enter the new value, and click "ENTER".

The Default value is 0.2 and the High-Accuracy value is 0.1. The entered value should be between 0.1 and 1.

Max Orient Error (deg)

This option is used to define and update the accepted error in orientation between two calculated TCP values to terminate the calibration process.

The currently set value will be displayed next to this option in degrees in the Define Settings Call.

To update this value, click on the number next to the option, enter the new value, and click "ENTER".

The Default value is 0.1 and the High-Accuracy value is 0.05. The entered value should be between 0.1 and 1.

Max Iteration

This option is used to define and update the maximum number of iterations the program will run when running a TCP Calibration if none of the above mentioned errors was met.

The currently set value will be displayed next to this option in the Define Settings Call.

To update this value, click on the number next to the option, enter the new value, and click "ENTER".

The Default value is 15 and the High-Accuracy value is 18. The entered value should be between 4 and 20.



MaxChange

MaxChange refers to the values of the thresholds for TCP update. The first threshold is "Update Threshold", and this refers to the threshold in error from which the software will require a full update to the TCP values. The second threshold is "Max Change From Setup TCP (mm)", and this refers to the threshold in error from which the software will alert the user to a physical defect in the torch that requires adjustment before being able to calculate a new TCP.

To define a MaxChange, the user will call "PERFECTPOINT_DEFINE_MAXCHANGE" in a TP program from the Macro tab.

Access the TP program and follow these prompts:

- NEXT
- F1-[INST]
- CALL
- CALL Program
- F2-Macro
- Select "PerfectPoint_DEFINE_MAXCHANGE"
- ENTER



Figure 3-27

To update the thresholds' values, click on the threshold parameters, enter the new value, and click "ENTER".

The Default value for Update Threshold is 0.5 and the High-Accuracy is 0.5. Then entered value should be between 0.1 and 2.

The Default value for the Max Change From Setup TCP is 15 and the High-Accuracy value is 15. The entered value should be between the Update Threshold's value and 20.

Choose which custom MaxChange to be updated by selecting the Custom MaxChange. Click on "F4-CHOICE" to select the Custom MaxChange profile from the pop-up screen.

1:	Customl	MaxChange	
2:	Custom2	MaxChange	
3:	Custom3	MaxChange	
4:	Custom4	MaxChange	
5:	Custom5	MaxChange	
6:	Custom6	MaxChange	
7:	Custom7	MaxChange	
8:	Custom8	MaxChange	
9:	Custom9	MaxChange	
10:	Customl) MaxChange	

Figure 3-28



Error Handling

The PerfectPoint software handles errors that may occur during execution. All errors are displayed in the alarm banner at the top of the teach pendant as shown below:

CUST-010 LECO - PP: Uninit Data. Set Custom Data Before Usin RESET

Figure 3-29

The user can also navigate to the alarm page to investigate the alarm further.



Figure 3-30

If the robot has calibration issues outside the tolerance thresholds set by Lincoln Electric, or the robot is not accurately mastered, the following message will be displayed:

Lincoln Electric PerfectPoint V 1.1 The Computed TCP is not acurate Please confirm robot calibration, validate PerfectPoint Settings and try again!

Figure 3-31

This message is just a warning, the program will continue to set up the frame values. However, some inaccuracy should be expected such as drifting or walking.



Section 4 FREQUENTLY ASKED QUESTIONS

What are the differences between Auto and Manual mode?

- Manual Mode: This mode will be active if the teach pendant is in the ON position. To move the robot while in this mode, the user must hold the Shift button down and depress the Dead-Man switch to the center position. This mode is usually used for testing and will require user interaction.
- Auto Mode: This mode will be active if the teach pendant is in the OFF position. This mode is usually used in production and will not require any user interaction.

Can I run the program on Cobot while the teach pendant is ON. ?

• No, the teach pendant must be OFF when running on a Cobot. Cobots only support Auto mode.

When I am touching up my point I am being asked to enter the tool frame, what should I do?

• The number of the tool frame is just for reference. The operator can use any number as long as that tool frame is active when attempting to move to one of these points without running the PerfectPoint.

Do I need to run setup again after physically adjusting my torch?

• Yes, the operator will need to run either RapidCheck or Setup after physically adjusting the torch to update the values stored.

Can I use the same computed Tool Center Point (TCP) on another torch?

• The values computed are based on the shape and dimensions of the torch. When values are changed, a new calibration must be run.

If you need further assistance, please contact the Lincoln Electric support team.



Section 5 TROUBLESHOOTING

Issue	Resolution Suggestion
Error - CUST- 010 LECO - PP: Setup Points Error. Joint Repair Required.	Position reference in Cartesian, change to joint position reference.
Error - MOTN - 018	Relocate PerfectPoint Measurement Device to a
Position not reachable (G:1)	location that ensures all positions executed are within the robot reach limit.



Section 6 DEFINITIONS AND TERMS

ТСР	Tool center point
Approach Point	A point close to the PerfectPoint device, perpendicular to the beam and not breaking it.
OnBeam Point	A point on the PerfectPoint device, perpendicular to the beam and breaking it.
True Point	A reference point using a pointer tip.
Touchup	Record the current position in the point in the TP program.

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WELD FUME CONTROL EQUIPMENT

The operation of welding fume control equipment is affected by various factors including proper use and positioning of the equipment, maintenance of the equipment and the specific welding procedure and application involved. Worker exposure level should be checked upon installation and periodically thereafter to be certain it is within applicable OSHA PEL and ACGIH TLV limits.



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