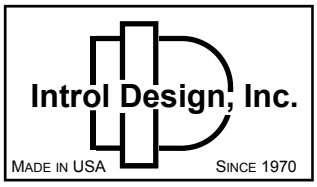
INTROL
ILC2100 SERIES OF INDEXERS
OPERATION MANUAL



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IMPORTANT

This control has been designed as a component intended to be implemented in a control system. Introl Design, Inc. has no control over the numerous control schemes, therefore it is the responsibility of the user to install this device in a system with the safeguards in place to prevent personal injury or equipment damage. The user should comply with the National Electrical Code as well as any local or other applicable codes. Although every effort has been made to assure the accuracy of the information contained in this manual, Introl Design, Inc. accepts no liability whatsoever with respect to the information provided herein. There are no implied warranties of merchantability or fitness for a particular purpose that apply to the control described in this manual.

Preface

Ever since the first model of the ILC2100 was introduced, we have kept a log of various customer comments and requests. Since the early days to date, 47 different versions have been developed and customized to fit the customer's need. As always, we value your comments and hope that the revised version of the operations manual, and the controller, will satisfy some of the newest requirements in industrial applications.

The information contained in this manual is expanded to include some of the specially designed versions of the ILC2100 series of controls. Please note that:

The ILC2100 (no suffix) does not have an active display to show the incremental length where the ILC2100A series, and all others, have the capability of displaying the actual length/position.

The ILC2100C series has all of the capabilities of the ILC2100A series, with the addition of electronic DC tach output to be used by the motor drive controller as a velocity feedback to improve the response of the drive.

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The Introl ILC2100 series of controls are 6 decade, 4 preset length/position controllers with batching, designed to meet the highest standards of today's industrial applications. The 2100 series of controls provide an isolated reference output to interface with isolated/unisolated servos and regenerative drives to control velocity and position. The ILC2100 series of controls are capable of establishing a precision reference point (home position) which lets them adapt to machine tool type applications, as well as a simple feed to length. For closed loop applications, it will accept a dual channel quadrature type encoder feedback with up to 50 kHz frequency external (3000 rpm with 1000 ppr encoder) with on board ×2 logic to improve the positioning accuracy. In stepper and microstepper applications, the ILC2100 can generate frequencies from 0 to 500 kHz. The sequence of operation is selectable, with batch counter ON/OFF to provide a flexible controller which easily will adapt to application needs.

Applications include: Press feeders, punch presses, positioning horizontal mill machines, and multi-station positioning tables.

FEATURES

- Isolated analog speed reference output.
- Compatible with servo and regenerative drives with optically isolated output.
- Compatible with steppers and microsteppers.
- Precision velocity and position control.
- Bi-directional indexing and jogging.
- 4-Preset length, 6-Decade in engineering units with decimal point.
- 4-Preset batch, 6-Decade with count down display and batch counter ON/OFF capability.
- Precision homing ability.
- Programmable 6-Decade calibrator with decimal point.
- Selectable auto drive offset drift compensation (caused thermally or due to change in load).
- Excellent repeatability.
- Real time position/length display.
- Interrupt input to stop feed and restart without loss of position
- Programmable auto display reset for cut to length, or external reset, only for positioning applications.
- Full duplex RS 232 with machine status report for remote process control. (Optional RS 422 available.)
- Nonvolatile RAM memory for program.
- Programmable at all times, even while indexing (on the fly).
- Programmable acceptance window (tolerance).
- Trapezoidal move profile with non-accumulative error indexing.

<continued>

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FEATURES (continued)

- Programmable in-position output (index complete).
- Programmable delay/pause before the in-position output is initiated.
- Operator station inputs for machine operation: run, reset, find home, jog forward, and jog reverse.
- Operational through front panel: run, program, jog forward, jog reverse, and cycle hold.
- Emergency stopping without losing batch count. (Jog modes are used to interrupt indexing.)
- Positional loop is closed at all times (except for steppers) while the power is ON.
- Access code is required to enter into the set-up mode to modify speeds, accel/decel, and calibrator.
- Programmable speed for each length, jog, home search, and home creep.
- Batch-complete output.
- 5 vdc power for encoder and external use.
- Rugged, anodized steel chassis for industrial environment.

SPECIFICATIONS

Input Power	115 vac ± 10%, 10 va, 50/60 Hz, optional 230 vac
Encoder Power	On board 5 vdc ± 5%, at 150 mA for external use.
Operation	Closed loop/open loop operation for both velocity and position. In closed loop, the unit will index from point to point to ± 1 input pulse from the encoder. The ILC2100 series will run at the precise speed programmed regardless of the load variations.
Length	4-Preset length bi-directional, 6-Decade each with decimal point at any position. Programmable in engineering units from 0.000001 to 999,999.
Batch	4-Preset batch 6-Decade each up to 999,999 with count down and batch counter ON/OFF programmability.
Speed	4-Preset length speeds, jog speed, home search speed, and home final approach speed. 1 to 255% of the selected speed range (selected speed base frequency).
Length/Position Calibrator	6-Decade. This is the number of encoder counts times 2 for closed loop, or the number of steps that will be measured to one unit of the desired measurement. Programming decimal points is permitted from 0.000001 to 999,999.

SPECIFICATIONS (continued)

Display Calibration	6-Decade with decimal point. To calibrate the position/length display to the desired engineering unit.
Position Counter	8-Decade. This is the number of encoder counts times 2, or the number of steps for steppers for each index preset length multiplied by the preset length calibrator, = number of steps. This should not be greater than 99,999,999.
Feedback Input	Incremental two channel with optional index marker for precision homing. Current sinking with pull-ups or TTL 90 degree quadrature type. Maximum feedback frequency 50 KC external. 5 vdc minimum to 15 vdc.
Home Limit Switch	Current sinking NPN type or contact closure, 24 vdc max.
Control Inputs	Current sinking NPN type or contact closure, edge and level sensitive. 5 vdc minimum to 24 vdc maximum.
Analog Output	Optically isolated bi-polar 0 to ±10 vdc at 5 mA.
Outputs	4 current sinking, open collector NPN type 100 mA at 24 vdc. Index complete output (in-position) momentary when the load is within the acceptance window. Output will be ON for the period of time programmed. (1 to 9,999 ms) Batch complete output, ON when final index is completed. Index and batch complete outputs will be reset by the run input to start a new batch. Direction output low (sinking) for (–) direction for steppers and microsteppers. Steps output DC to 500 KC. 50% duty cycle normally OFF for steppers and microsteppers.
Serial Interface	RS 232 standard. Baud rate selectable 300, 600, 1200, 2400, 4800. Full duplex, 8 data bits, one start and stop bits.
Display	8-Decade 0.6" red LED. Modified alpha and numeric.
Mechanical	Steel enclosure with cast aluminum bezel and easy disconnect terminal blocks. Water-proof oil resistant keyboard.
Dimensions	5.375" W × 3.00" H × 7.350" Deep. Bezel size 6.625 " × 4.00".

INITIAL SET-UP PROCEDURE

The ILC2100 series is factory set to operate with 115 vac power unless otherwise specified. To operate with 230 vac, remove the unit from its chassis and connect the jumpers near the fuse on the bottom board from B to C and from D to C. Make sure that the jumpers are a snug fit. Put the unit back into its chassis. For steppers and microsteppers, logic L5 in the top board must be removed.

The installation of this device must conform with local and national electric codes.

1. Before connecting a servo drive to the ILC2100, set up the drive as follows:

   A. With 0.0 vdc reference into the drive, set the drive bias for zero speed.

   B. With 9 vdc reference input to the drive, set the gain/speed/tach adjustment of the drive so that the motor speed is at maximum operating speed. This is to insure that the output of the ILC2100 does not get saturated during indexing. If the output remains in saturation (full ±10 vdc for a period of time) the ILC2100 will decelerate to a stop with "ERROR" displayed on the front panel.

   C. Set the response of the drive to a moderate response, so that the drive is not sluggish.

   D. Set the accel/decel of the drive to as fast as possible. Zero accel/decel time is preferred in the drive. The ILC2100 will generate the acceleration and deceleration ramps.

   Before connecting the drive to the ILC2100, the drive must be set up properly to vary speed as the input reference varies, and reverse direction as the input reference polarity changes.

2. Remove the top cover of the ILC2100 to facilitate setting of the base frequency and gain switches. By using the following formula, calculate the base frequency preset number. This number is a function of the maximum speed and the resolution of the incremental encoder (rotopulser) or stepper used. As an example, assume that a 1000 pulse per revolution encoder is directly coupled to the motor shaft, with a maximum speed of 2000 rpm at the motor shaft.

$$\text{Preset \#} = \frac{195312.5}{\text{Frequency at the Maximum Speed}}$$

$$\text{Frequency} = \frac{2000 \times (1000 \times 2)^*}{60} = 66{,}667 \text{ pulses/second}$$

The calculated number must never be greater than 100,000. This is the maximum feedback frequency after times two logic. Now calculate the preset number for the SW3 group of switches.

$$\text{Preset \#} = \frac{195312.5}{\text{Maximum Internal Feedback Frequency or Step}}$$

$$\text{Preset \#} = \frac{195312.5}{66{,}667} = 2.93 \text{ (approximately 3)}$$

INITIAL SET-UP PROCEDURE (continued)

Program this preset number into the SW3 set of DIP switches. This switch is binary, and the weight, or value, of each is given below.

Switch #	1	2	3	4	5	6	7	8	9	10	11	12
Value	1	2	4	8	16	32	64	128	256	512	1024	2048

Turn ON those switches whose values add up to the calculated preset number. For example, for the calculated preset number of 3, turn ON switches 1 and 2 only on the SW3 group of switches. Programming 100% speed from the front panel will correspond to:

$$\text{Actual Speed} = \frac{1953.125 \times \text{Programmed Speed} \times 60}{\text{SW3 Preset Number} \times (\text{Encoder Resolution} \times 2)}$$

$$= \frac{1953.125 \times 100 \times 60}{3 \times (1000 \times 2)^*} = 1953.125 \text{ rpm}$$

Each 1% of change in programmed speed will vary by 19.53125 rpm exactly

***Note:** For steppers and microsteppers, follow the above calculations and use the number of steps per revolution rather than encoder resolution, and omit ×2 from the equations.

3. SW1 and SW2 groups of DIP switches are for servo drives only. For stepper applications, all SW1 switches should be set to ON, and all SW2 switches should be set to OFF.

   A. **SW1 group of switches:** This is the closed loop gain setting. It is furnished as an internal setting to avoid operator tampering or reprogramming. This group of switches should be set with the power ON and drive enabled. Prior to power up, set switch number one on this set to ON, which is a low gain setting. After power up, gradually increase the gain by turning ON the next higher value switch and turning OFF the previous switch. Continue increasing the gain until oscillation is encountered, and then reduce by one step. Combined selection of the switches is also possible.

   B. **SW2 group of switches:** On earlier versions of the ILC2100 series, the acceptance window was programmable by switches 1 - 7 of this group. These switches are now only used by the ILC2100 (no suffix) to provide this acceptance window. The switch group is binary weighted to set the ±error window allowed before in-position output is initiated.

      Switch #8 in this group of switches is used to enable the compensation circuitry to avoid any analog thermal drift or compensation for overhanging loads (or side loads).

      Switch #8 is particularly useful when the ILC2100 is used in absolute mode.

   Note that once the internal switches are set, you may never need to modify them. Put the cover back on.

INITIAL SET-UP PROCEDURE (continued)

WARNING: There are two (some versions have three) separate terminal blocks provided at the rear of the ILC2100 series. The lower 20 pin terminal is used for power and all discrete input/output. The upper 8 pin terminal is electrically isolated from the lower terminal to provide an isolated speed reference to the drive. *DO NOT MAKE ANY CONNECTIONS BETWEEN THE UPPER TERMINAL AND THE LOWER, OR TO EARTH GROUND.*

4. Make all connections in accordance with the hook up diagram provided at the end of the manual. Use the cut-out dimension and template provided for enclosure mounting. Make sure to use earth ground where it is designated, and use shielded cables, with the shield connected to common on the ILC2100.

   To avoid noise problems, keep the signal wires away from other wires carrying high current. Use shielded cables where designated. All AC/DC relay coils, motor starters, and solenoids used as part of the system must be suppressed.

5. Turn the power ON and turn the motor controller ON. The motor should hold position. If the motor runs away, disconnect the power and reverse channel A and channel B of the encoder.

6. Follow the programming sequence for programming the parameters.

PROGRAMMING

Programming the ILC2100 series is permitted only when the run light is OFF (device at reset) or flashing (programming on the fly). The ILC2100 series can be programmed through the front panel keypad or through the serial port. In either case, the sequence of the programming remains the same to minimize confusion. The programming procedure is straightforward. It always starts at line 1 (at the top) and as ▼ or ▲ is depressed it enters and scrolls to the next or previous menu.

At the first level of programming, presetting lengths and batches is allowed. An access code is required to enter into the second level of programming, which permits other parameters to be programmed or altered. One or all of the parameters can be altered without any restrictions. The sequence of programming is illustrated and explained in following pages.

The ILC2100 series accepts data alterations and will respond to changes on the next immediate index. Note that if the batch counters are set ON and the indexing has begun, modifying the batch presets will not affect the content of the batch counters. The batch presets are loaded into the batch counters at the first run command after power up or after the presets are batched out. Reset input from the operator station will refresh the content of the batch counters, as well as resetting the sequence of the operation and length/position display.

FIRST LEVEL PROGRAMMING

1. Length "a" in user defined units. Six decade with direction.
2. Batch "a" preset. Six decade.
3. Length "b" in use defined units. Six decade with direction.
4. Batch "b" preset. Six decade.
5. Length "c" in use defined units. Six decade with direction.
6. Batch "c" preset. Six decade.
7. Length "d" in use defined units. Six decade with direction.
8. Batch "d" preset. Six decade.
9. Code entry of "8788" will permit access to second level of programming.

SECOND LEVEL PROGRAMMING

10. Percent speed "a". 1% to 255% of the selected base frequency (speed).
11. Percent speed "b". 1% to 255% of the selected base frequency (speed).
12. Percent speed "c". 1% to 255% of the selected base frequency (speed).
13. Percent speed "d". 1% to 255% of the selected base frequency (speed).
14. Percent speed "H". Home search 1% to 255% of the selected base frequency (speed).
15. Percent speed "L". Home final approach 1% to 255% of the selected base frequency (speed).
16. Acceleration/deceleration time. From 0 seconds to 6.0 seconds in 0.1 second increments. This is the time to reach 100% speed. (See note, page 8.)
17. Position/length calibrations. Six decade with decimal point. This is the number of steps or number of encoder pulses times 2 that equals one unit of measurement.
18. Percent speed "J". Jog speed 1% to 255% of the selected base frequency (speed).
19. In-position output hold time (index complete). From 0 to 9999 ms (0 to 9.999 seconds).
20. Delay/dwell. Delay time from the time that index is completed until in-position output is initiated. From 0 ms to 9999 ms (0 to 9.999 seconds).
21. Batch counters ON/OFF switch. It will toggle when "CLEAR" is pressed.
22. Pattern of execution. Refer to page 12 for functional description.
23. Baud rate. Program the desired baud rate: 300, 600, 1200, 2400, 4800.

<continued>

SECOND LEVEL PROGRAMMING (continued)

*24. Display calibrator. Six Decade with decimal point. This is the reciprocal of the position/length calibrator (line 17) multiplied by the desired number to be displayed per unit of length, ignoring the decimal point. (For example, to display 1.000 for one inch, ignoring the decimal point, use 1000 as the multiplier.)

*25. Position of decimal point placed on display.

*26. Length tolerance programmed in unit of length for both (+) and (–) tolerances. (For example, program 0.005 for a tolerance of ±0.005 inches. This is the window in which in-position output will be initiated.)

Note: By programming the acceleration/deceleration time the user is actually programming the rate. For example, if 6 seconds is programmed, it means it will take 6 seconds to reach 100% speed. If speed is programmed 50%, then it will take 3 seconds to reach 50% speed. If 200% speed is programmed, it will take 12 seconds to reach 200% speed. If it is desired to calculate the accel/decel rate as a reference, use the following formula:

$$\text{Accel/Decel Rate} = \frac{\text{Speed in user's unit at 100\%}}{\text{Accel/Decel Time Programmed}}$$

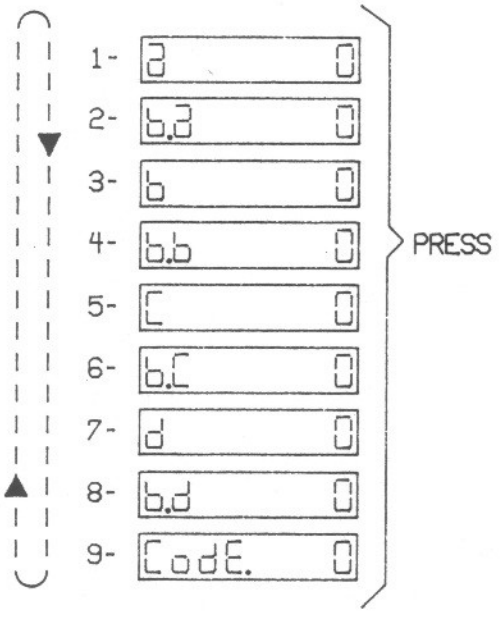
As an example, a cut to length line is running at 50 inches per second. When 100% speed is programmed the accel/decel is programmed at 0.2 seconds.

$$\text{Accel/Decel Rate} = \frac{50 \text{ in/sec}}{0.2 \text{ sec}} = 250 \text{ in/sec}^2$$

* Not included on the ILC2100 (no suffix).

PROGRAM VERIFICATION OR ALTERATION IS PERMITTED
ONLY WHEN THE RUN INDICATOR LIGHT IS OFF OR FLASHING

1ST LEVEL PROGRAMMING



0 THRU 9 ENTERS DATA VALUES

▼ ENTER AND SCROLL DOWN

▲ ENTER AND SCROLL UP

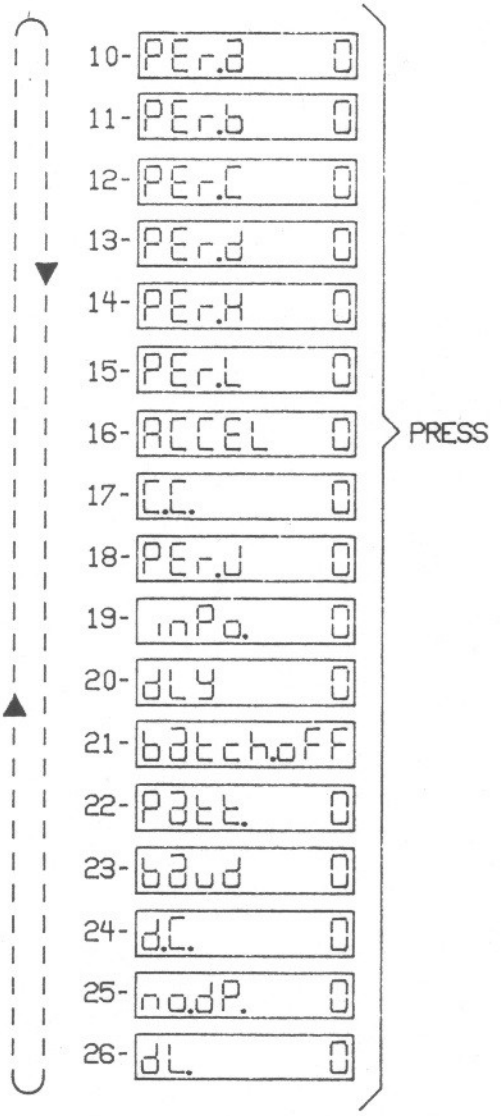
JOG TO ENTER JOG MODE

PGM RUN TO ALTERNATE BETWEEN RUN AND PROGRAM MODE

CLR TO CLEAR DISPLAY OR EXIT JOG MODE OR HOLD MODE

8 7 8 8 ▼

2ND LEVEL PROGRAMMING



0 THRU 9 ENTERS DATA VALUES

▼ ENTER AND SCROLL DOWN

▲ ENTER AND SCROLL UP

JOG TO ENTER JOG MODE

PGM RUN TO ALTERNATE BETWEEN RUN AND PROGRAM MODE

CLR TO CLEAR DISPLAY OR EXIT JOG MODE OR HOLD MODE

OPERATION

The ILC2100 assumes the program mode at power up, and will display the pre-programmed value of preset A (the first preset). At this point, it opens the serial communication channel and waits for commands from the front panel, serial port, or operator station inputs. Once the serial port receives a valid serial mode request, it locks out the front panel keypad and initiates remote operation through the serial port. The operator station inputs for machine operation remain active regardless of the mode in which the ILC2100 is being operated.

Once the run command is initiated via external input, the run indicator light will illuminate, and the display will show the length/position or the batch countdown, based on the display function selected by steps #21 and #22 at set-up. To access programming mode, depress PGM/RUN. The run light will start flashing on and off, indicating programming on the fly mode, starting from line 1 of the set-up. Once programming is completed, depression of PGM/RUN will return to display mode.

To return to programming on the fly mode, depress the PGM/RUN key. The run indicator light will start flashing and data entry begins from from line 1 in the programming sequence. If the initial run command was initiated from the operator station input, the run indicator light will be ON and the display will show the length/position or batch count down. Again, if it is desired to modify/verify the programmed presets, depress the PGM/RUN key.

While in run mode, depressing the ·/HOLD key will stop the sequence of the operation, with the display flashing "HOLD". Depressing CLEAR restarts the sequence. Pressing the PGM/RUN key toggles between the program and the run mode.

The JOG key starts the jog mode. While indexing, depressing JOG or receiving a jog command from the operator station will interrupt the indexing operation. The motor will decelerate to a stop at the programmed accel/decel time. Entering the jog mode does not disturb the batch counters or the sequence of the operation. While in jog mode, depressing ▲ will accelerate the motor in a (–) negative direction to the jog speed that is programmed in at line 18. The motor will run at that speed until the key is released, and then decelerate to a stop. Depressing the ▼ key jogs the motor in a (+) direction. Depress the CLEAR key to exit the jog mode and enter the program mode.

The ILC2100 either executes the programmed presets sequentially, or the first preset will batch out before the next preset is executed (program 1 or 3 for the pattern in line 22). In either mode the batch counter can be set ON or OFF. If the batch counter is ON in line 21 for sequential mode, the first non-zero preset length and batch will be executed once, then the next preset, and so on. Each time a preset is executed, the batch counter of that preset is decremented by one until zero is reached. Then that preset will be skipped in the sequence of operation.

When all the preset batches have reached zero, the ILC2100 will turn on its batch complete output and wait for a command. An additional "run" input will restart the sequence with a refreshed batch counter. In the sequential mode, if the batch counter option of the ILC2100 is set OFF, it will sequence without stopping, ignoring the content of the batch presets. If sequential indexing is not selected with the batch counter set ON, the ILC2100 will execute the first non-zero preset length and batch. It will then initiate a batch complete output and wait for a "run" command before executing the next non-zero preset, and so on. When the

OPERATION (continued)

last non-zero preset is batched out, it will re-execute the first non-zero preset and continue on. If the batch counter is not set ON, **only** the first non-zero preset length will be executed without affecting the batch counters.

In either case, the ILC2100 will generate an in-position output (index complete) for the period of time programmed in line 19 of the programming sequence. In addition, if it is desired, a useful programmable dwell/delay is utilized in which the ILC2100 series will allow the in-position output to be delayed between the time that the index is completed and the acceptance window is satisfied, until the in-position output is initiated.

The find home command can only be initiated through the operator station input or through the serial port. With the reception of the find home command the ILC2100 will test the condition of the home limit switch. If the home limit switch is OFF it will accelerate in a (–) negative direction to the percent "H" speed programmed in line 14 of the programming sequence. When the home limit switch is sensed it will then decelerate to a stop at the programmed time. (This portion would be skipped if the limit switch was ON.) It then reverses direction and accelerates to the percent "L" speed programmed in line 15. The motor will run at this speed until it detects the edge of the limit switch that was sensed previously, and will decelerate to a stop. It now will reverse direction and move in a (–) negative direction, again at percent "L" speed that is programmed in line 15, but this time it must receive two inputs, one from the home limit switch and the other from the index marker of the encoder. The motor will now stop. The final homing move is to reverse direction and once again move in a (+) positive direction. This is done to compensate for any backlash that may exist in the system. The motor moves until the home limit switch and the index marker pulse of the encoder are received.

The homing ability of the ILC2100 series is the most precise method existing today, with excellent repeatability of ±1 count of the encoder in closed loop systems. If a marker pulse is not used, connect the home limit switch to both the home limit switch input and the index marker input. Homing is only used in positioning applications and is not of use for feeders.

Important: The home limit switch input should be placed to provide deceleration or stopping distance from the end of the travel during the home search. This distance can be measured either by trial or mathematically. The stopping distance from the leading edge of the home limit switch can be calculated by using the following formula:

$$\text{Stopping Distance} = \frac{\text{Actual Speed (sec)} \times \text{Percent "H" Speed} \times \text{Accel Time}}{2}$$

In the formula above, the stopping distance will be in the unit of the actual speed that is used in the calculation.

For example, if percent "H" speed is programmed 45%, the acceleration is 0.2 seconds, and the actual speed of the motor is 823 revolutions per minute or 823/60 revolutions per second, the stopping distance will be:

$$\text{Stopping Distance} = \frac{823 \times 45 \times 0.2}{60 \times 2 \times 100} = 0.62 \text{ revolutions}$$

Note that this is the minimum stopping distance required. Allow some safety margins to avoid tool collision.

PATTERNS OF OPERATION

Following is the description of the pattern of operation for various numbers programmed in line 22 of the set-up parameters.

Pattern	Functional Description (With the batch counter set to ON in line 21.)
0	Display length in progress. The batch complete output will be initiated after each batch is done. Display resets to zero automatically prior to motion.
1	Display length in progress. Sequential indexing. Output batch complete when all batches are complete. Display resets to zero automatically prior to motion.
2	Display relative position with respect to home or starting point after reset. The batch complete output will be initiated after each batch is done. Display will only reset by external reset input.
3	Same as (2) but sequential indexing and batch complete output will be initiated when all batches are complete.
4	Display batch countdown. The batch complete output will be initiated after each batch is done.
5	Display batch countdown. Sequential indexing. The batch complete output will be initiated after all batches are done.
10	Same as (0) but batch complete output will be initiated after all batches are done.
12	Same as (2) but batch complete output will be initiated after all batches are done.
14	Same as (4) but batch complete output will be initiated after all batches are done.

Pattern	Functional Description (With the batch counter set to OFF in line 21.)
0	Display length in progress. Display will reset to zero automatically prior to motion.
1	Display length in progress. Sequential indexing. Display will reset to zero automatically prior to motion.
2	Display relative position with respect to home or starting point after reset.
3	Same as (2) but sequential.

SERIAL INTERFACE RS 232 STANDARD (Optional RS 422, contact factory)

The RS 232 interface of the ILC2100 series is a 3-wire full duplex 8-Bit ASCII. One start and one stop bit at the user programmed baud rate, parity is not checked. The ILC2100 allows full programming through the serial port with user friendly, menu driven sequential prompting. To make connection, the remote terminal should transmit on ASCII (OD) which is "enter" or "carriage return." The ILC2100 will transmit back to the remote terminal:

ILC2100
READY,

This will initiate the command mode in which the remote terminal may select one command at a time to instruct the ILC2100. In response to each valid command for acknowledgment it will transmit back to the terminal:

OK READY,

At the end of each command, the enter/carriage return must be received, otherwise the command will be ignored. To simplify programming and to reduce confusion for those who program through the front panel and through the serial port, the sequence and the format remain the same. Again, Programming while the unit is running is completely acceptable. The optional operator station inputs are functional at all times. Programming commands that the ILC2100 series will recognize should be all in capital letters, and they are as follows:

Command	Description
PG and enter	Enter the program mode.
ST and enter	Report status. This option commands the ILC2100 to report to the terminal the sequence of the operation, present batch count, index complete, and batch complete. The ILC2100 remains in the command mode for additional commands. Escape input will abort the status report command.
HL and enter	Hold the indexing sequence. Same as hold key on front panel.
JG and enter	Enter into the jog mode.
GO and enter	Run/index/execute.
RS and enter	Initiate batch counter and sequence of the indexing.
HM and enter	Establish a home position. Go home.
KB and enter	Exit serial mode. Disconnect from serial port and go to front panel mode.
Control U	Emergency stop (halt).
ESC	To abort status report. To return to command mode while in program mode.

SERIAL INTERFACE RS 232 STANDARD (continued)

Program Mode Instruction

ESC	To exit program mode and return back to the command mode.
D	To enter and scroll down. Receiving a character "D" is the same as ▼ on the front keypad.
U	To enter and scroll up. Same as ▲ on the front keypad.
C	To clear previously entered data and initiate new data entry. Even though the previously entered data is zero, it still needs to receive the character "C" before permitting any numeric data entry.
+, –, . , 0-9	Data entry values.

Jog Mode

If in the command mode and "JG" and "enter" are received, and the reception happened to occur during an index, it will cause an interruption in the indexing sequence. The motor will decelerate to a stop and then the ILC2100 will transmit back to the terminal:

+ or – JOG
S TO STOP?

The terminal command should be (+) for jog in the (+) direction, and (–) for jog in the (–) direction. As soon as the direction command is received by the ILC2100, it will accelerate to the programmed jog speed at the acceleration time programmed. The motor will run at a constant velocity until the character "S" is received from the remote terminal. This commands the ILC2100 to decelerate to a stop at the programmed accel/decel time. The jog mode will remain active until the escape character is received, at which time it will exit the jog mode and return to the command mode.

Entering the jog mode does not affect the batch count or the sequence of the indexing operation. Interrupting an index will result in an incorrect length in progress at that time. The next index will start from this point on.

The following are some actual samples of the program execution. The preset values are for reference only and to show the different modes.

◊◊ Sample Program Verification ◊◊

ILC2100	%SPEED B 80
READY, PG	%SPEED C 200
LENGTH A 20	%SPEED D 46
BATCH A 5	%SPEED H 50
LENGTH B 30.05	%SPEED L 2
BATCH B 4	ACCEL. .1
LENGTH C -18.258	CAL.CON. 1000
BATCH C 6	%SPEED J 10
LENGTH D 1.75	INPO.OUT 200
BATCH D 3	DELAY 1000
CODE??? C	BATCHoff
CODE??? 8788	PATTERN
%SPEED A 100	BAUD RT. 4800

◊◊ Sample Program Execution Single Preset Without Batching ◊◊

ILC2100
READY, ST – ENABLE STATUS REPORTING

OK, READY, GO – GO/RUN COMMAND

LENGTH A 20
OK, READY, INDEX COMPLETE
LENGTH A 20 INDEX COMPLETE
LENGTH A 20 INDEX COMPLETE
LENGTH A 20 INDEX COMPLETE
LENGTH A 20 INDEX COMPLETE
LENGTH A 20 INDEX COMPLETE
LENGTH A 20 INDEX COMPLETE
LENGTH A 20 INDEX COMPLETE
LENGTH A 20 INDEX COMPLETE
LENGTH A 20 INDEX COMPLETE
LENGTH A 20 INDEX COMPLETE

◊◊ Sample Program Execution Four Presets With Batch ◊◊

```
ILC2100
READY, ST                                   – ENABLE STATUS REPORTING

OK, READY, GO                               – GO/RUN COMMAND

BATCH A 5
OK, READY,          INDEX COMPLETE
BATCH A 4           INDEX COMPLETE
BATCH A 3           INDEX COMPLETE
BATCH A 2           INDEX COMPLETE
BATCH A 1           INDEX COMPLETE
BATCH A             BATCH  COMPLETE
READY,
READY, GO                                   – GO/RUN COMMAND

BATCH B 4
OK, READY,          INDEX COMPLETE
BATCH B 3           INDEX COMPLETE
BATCH B 2           INDEX COMPLETE
BATCH B 1           INDEX COMPLETE
BATCH B             BATCH  COMPLETE
READY,
READY, GO                                   – GO/RUN COMMAND

BATCH C 6
OK, READY,          INDEX COMPLETE
BATCH C 5           INDEX COMPLETE
BATCH C 4           INDEX COMPLETE
BATCH C 3           INDEX COMPLETE
BATCH C 2           INDEX COMPLETE
BATCH C 1           INDEX COMPLETE
BATCH C             BATCH  COMPLETE
READY,
READY, GO                                   – GO/RUN COMMAND

BATCH D 3
OK, READY,          INDEX COMPLETE
BATCH D 2           INDEX COMPLETE
BATCH D 1           INDEX COMPLETE
BATCH D             BATCH  COMPLETE
READY,
READY, GO                                   – GO/RUN COMMAND

BATCH A 5
OK, READY,          INDEX COMPLETE
BATCH A 4           INDEX COMPLETE
BATCH A 3           INDEX COMPLETE
```

◊◊ Sample Program Execution Sequential Four Presets With Batch ◊◊

```
ILC2100
READY, ST                              – ENABLE STATUS REPORTING

OK, READY, GO                          – GO/RUN COMMAND

BATCH A 5
OK, READY,
BATCH B 4          INDEX COMPLETE
BATCH C 6          INDEX COMPLETE
BATCH D 3          INDEX COMPLETE
BATCH A 4          INDEX COMPLETE
BATCH B 3          INDEX COMPLETE
BATCH C 5          INDEX COMPLETE
BATCH D 2          INDEX COMPLETE
BATCH A 3          INDEX COMPLETE
BATCH B 2          INDEX COMPLETE
BATCH C 4          INDEX COMPLETE
BATCH D 1          INDEX COMPLETE
BATCH A 2          INDEX COMPLETE
BATCH B 1          INDEX COMPLETE
BATCH C 3          INDEX COMPLETE
BATCH D
BATCH A 1          INDEX COMPLETE
BATCH B
BATCH C 2          INDEX COMPLETE
BATCH A
BATCH C 1          INDEX COMPLETE
BATCH C            BATCH  COMPLETE
READY,
READY,
```

◊◊ Sample Program Execution Sequential Four Presets Without Batching ◊◊

```
ILC2100
READY, ST                              – ENABLE STATUS REPORTING

OK, READY, GO                          – GO/RUN COMMAND

LENGTH A 20
OK, READY,         INDEX COMPLETE
LENGTH B 30.05     INDEX COMPLETE
LENGTH C -18.258   INDEX COMPLETE
LENGTH D 1.75      INDEX COMPLETE
LENGTH A 20        INDEX COMPLETE
LENGTH B 30.05     INDEX COMPLETE
LENGTH C -18.258   INDEX COMPLETE
LENGTH D 1.75      INDEX COMPLETE
LENGTH A 20        INDEX COMPLETE
LENGTH B 30.03     INDEX COMPLETE
LENGTH C -18.258   INDEX COMPLETE
LENGTH D 1.75      INDEX COMPLETE
LENGTH A 20        INDEX COMPLETE
```

TROUBLESHOOTING

Power has been applied to the unit and nothing is shown on display.

- Remove all connections from the ILC2100 except power. Apply power. If the unit works, then you may have an external short in one of the wires connecting to the ILC2100, possibly the +5 volt supply. If the unit still doesn't work, disconnect the power. Remove the ILC2100 from its chassis and check the fuse.

Servo motor runs away and the ILC2100 displays "L.G. ERROR".

- Encoder Channel A and Channel B are reversed.
- Loose coupling between encoder and the driving shaft.
- Bad encoder.

System does not jog or run.

- Remove connection between the ILC2100 and the drive. Try running the drive in both directions.
- Check for zero speed programmed into the ILC2100.

Motor overshoots during acceleration and deceleration.

- Acceleration is too fast for the load.
- Drive goes into current limit (not enough torque).
- Response of the drive is too slow.
- Accel/decel of the drive is not set to the fastest rate.
- Output of the ILC2100 reaches full 10 vdc.
- **Note:** If all the adjustments are made to the drive and overshooting still occurs, you must increase the accel time on the ILC2100. This will reduce the accel torque, and in turn will reduce the current requirements for acceleration and deceleration.

Motor runs OK in low speed, but in higher speeds it runs away.

- Check for earth ground connection to terminal 15.
- Check maximum external feedback frequency. Encoder frequency should exceed 50 kHz.
- Check encoder Channel A and B for symmetry and 90° offset between the two channels.

APPLICATION NOTES

FIGURE 1 A Typical Feeder Application

In the typical feeder application shown in Figure 1, the press runs at a constant rate of speed and the material is fed into the press before the press reaches the material surface. A limit switch initiates the index command by detecting a particular point on the press when it is in the upstroke cycle. The ILC2100 is a perfect choice for this application because of its programmability on the fly which will not interfere with the press operation, or force a shut down period.

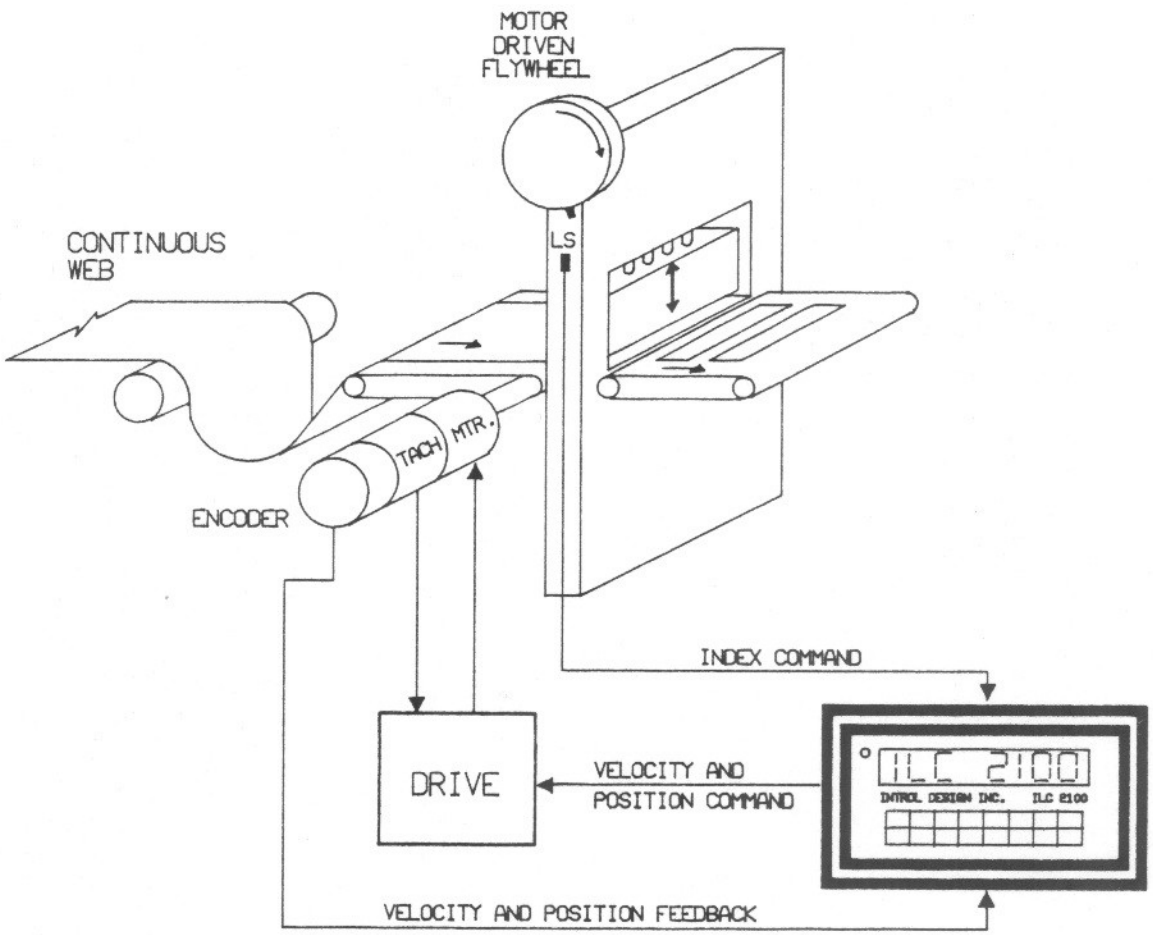


FIGURE 1. CONTINUOUS WEB PRESS FEEDER

FIGURE 2 A Typical Hot Stamping Operation <see page 22>

This illustration shows a typical hot stamping operation where multicolor printing on a product is required. In this application, after power up, a home command will initiate the system and position the work surface at the loading station (home position). The distance between the loading station and station #1 is programmed as ***Preset A***. The distance from station #1 to station #2 is ***Preset B***, from station #2 to station #3 is ***Preset C***, and from station #3 to the unloading station is ***Preset D***.

The ILC2100 should be programmed to do a sequential execution. Operation begins by loading the product at the loading station and initiating a run/index command. The ILC2100 will execute ***Preset A*** and position precisely at station #1, giving an in-position output at terminal #2, and also to the remote terminal. After completion of the process, with additional run commands, the ILC2100 will execute ***Preset B*** to go to station #2, and ***Preset C*** to go to station #3, and the final run command will position the finished product at the unloading station. Once the finished product is removed, a find home command sends the work surface back to the loading station to repeat the process.

The loading and unloading of the products may be done by human operators or by robots. In either case, the ILC2100 provides all the handshake signals required. Furthermore, the batch counting capability of the ILC2100 can be used to keep track of the number of pieces that have been handled. If each station should require an input from the ILC2100, additional limit switches must be placed at each station, and the signals from each limit switch must be *anded* with the in-position signal output of the ILC2100 so that each station will receive an in-position signal when the product is at that station.

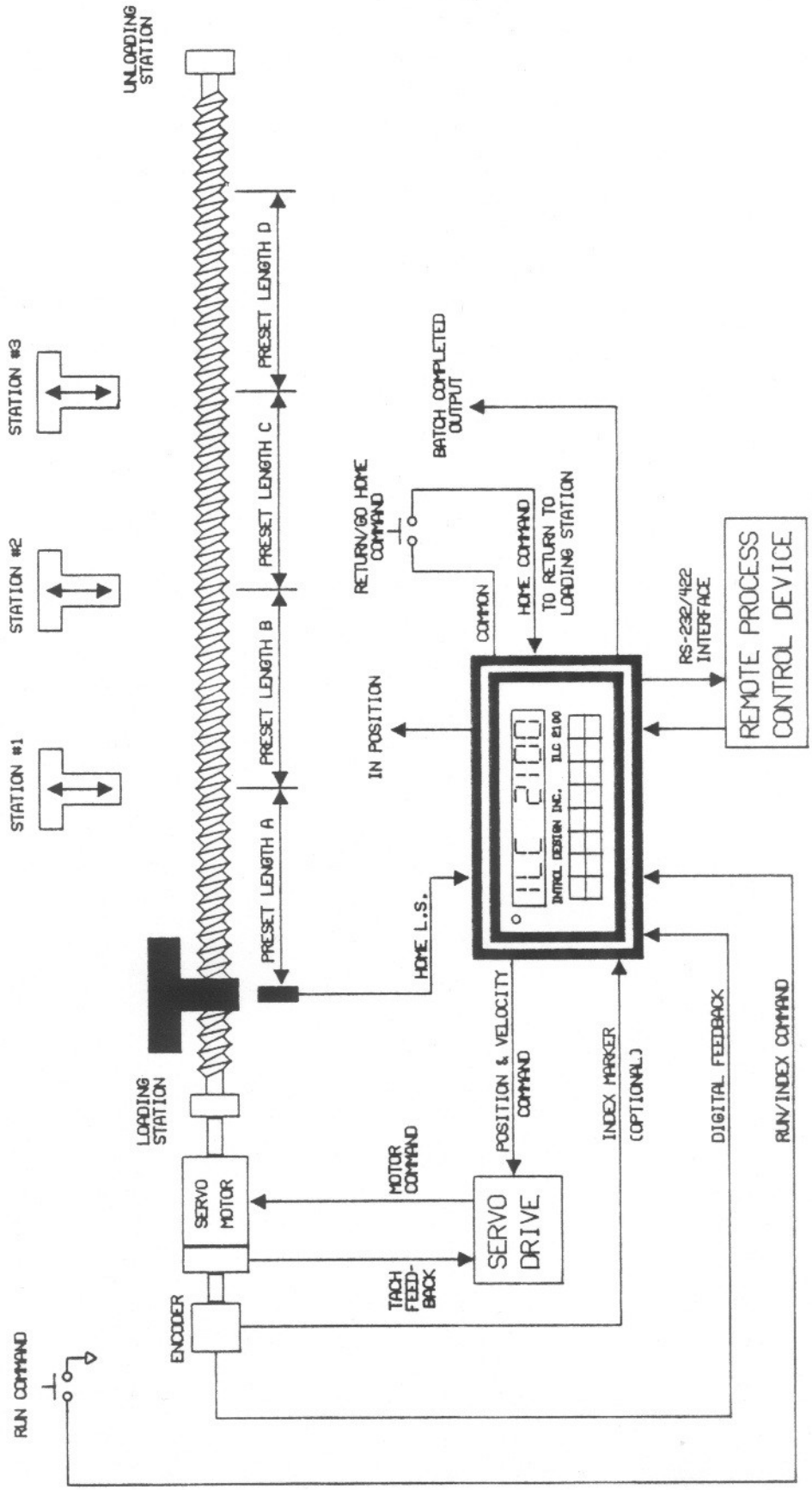


FIGURE 2.
3 COLOR HOT STAMPING WITH
LOADING AND UNLOADING STATIONS

ILC2100C VERSIONS

The following instruction is provided for the ILC2100**C** versions only.

The "C" versions of the ILC2100 series of controllers are designed to generate an electronic tach output to close the velocity loop of the drive. This signal becomes useful when used in conjunction with a regenerative drive, since it is difficult to install both the encoder and the tach generator on the motor. The ILC2100C series of controllers converts the information received from the encoder to an analog signal proportional to the speed. This signal can then be used as a crude form of tach feedback. Of course, at zero velocity, depending on the response setting, a choppiness may be experienced. It is recommended that an encoder resolution of 500 ppr is used.

If the device has been purchased as a package (drive and motor), the potentiometer and gain settings are preset at the factory for your application.

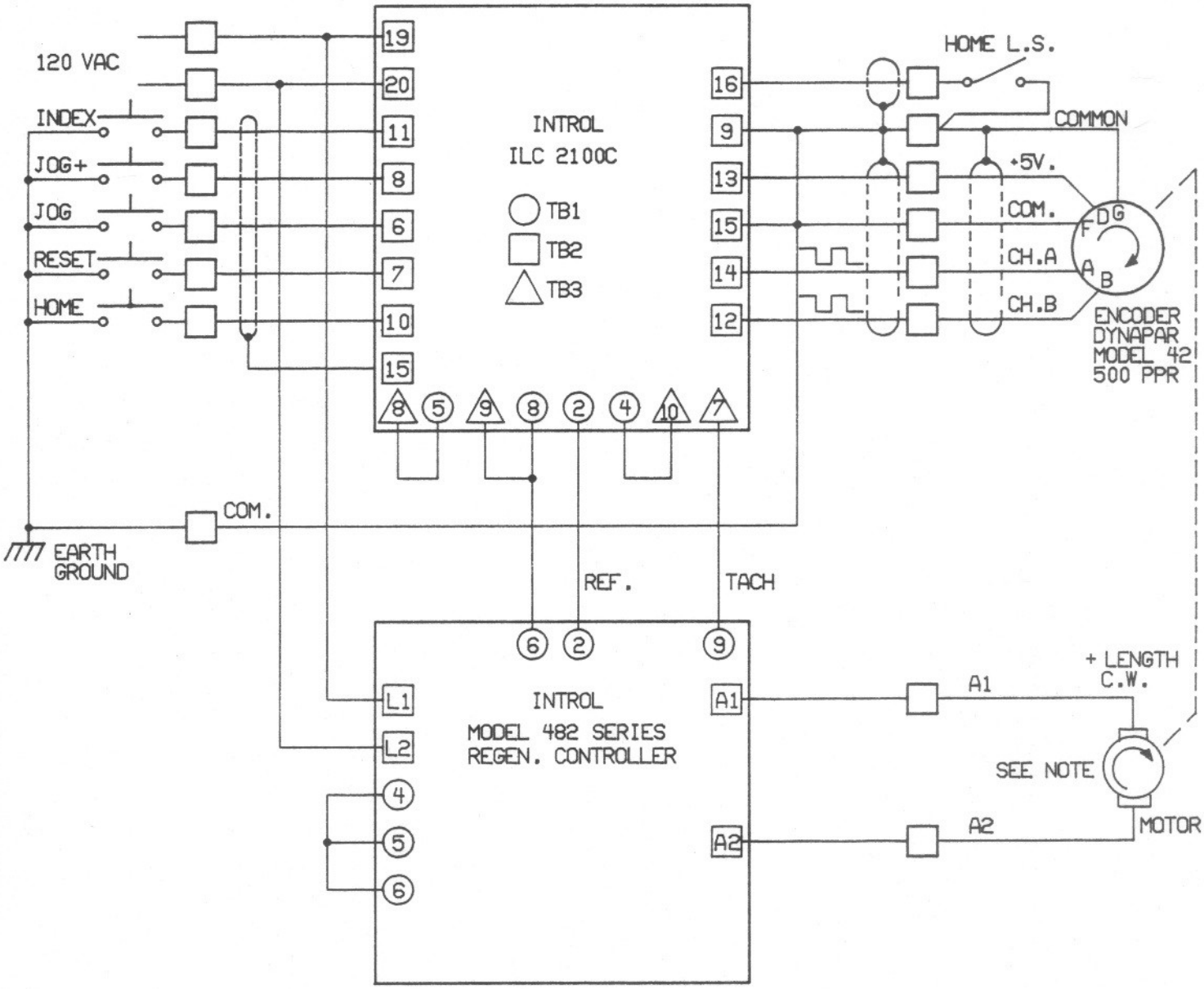
SET-UP

1. Refer to the connection diagram furnished. Connect all of the wires with the exception of the reference to the drive. Set up the drive for voltage feedback (CEMF) mode for now.

2. Connect a speed pot to the drive as instructed by the drive manufacturer. Start and run the motor at 110% of the operating speed. (Note that the maximum operating speed may not necessarily mean the maximum motor speed.) Measure the tach output from the ILC2100 with respect to the drive common, adjust the tach pot through the side access hole until a reading of 8 volts has been obtained.

3. Stop the drive and remove power. Set up the drive for the tach feedback mode using the tach from the ILC2100. Restart the drive and the ILC2100, run forward and backward. If the motor runs away when the drive and the ILC2100 are turned on, the polarity of the tach is reversed. Stop the drive and the ILC2100, use the other tach output from the ILC2100.

4. Remove the speed pot, then connect the reference output from the ILC2100 to the reference input of the drive.



NOTE: THE CONNECTION DIAGRAM PROVIDED IS FOR CW ROTATION WHEN COMMANDED TO RUN IN (+) DIRECTION WITH ENCODER CHANNEL A LEADING B. FOR CCW ROTATION, FOR (+) DIRECTION REVERSE A1, A2 ALSO REVERSE CH. A, CH. B

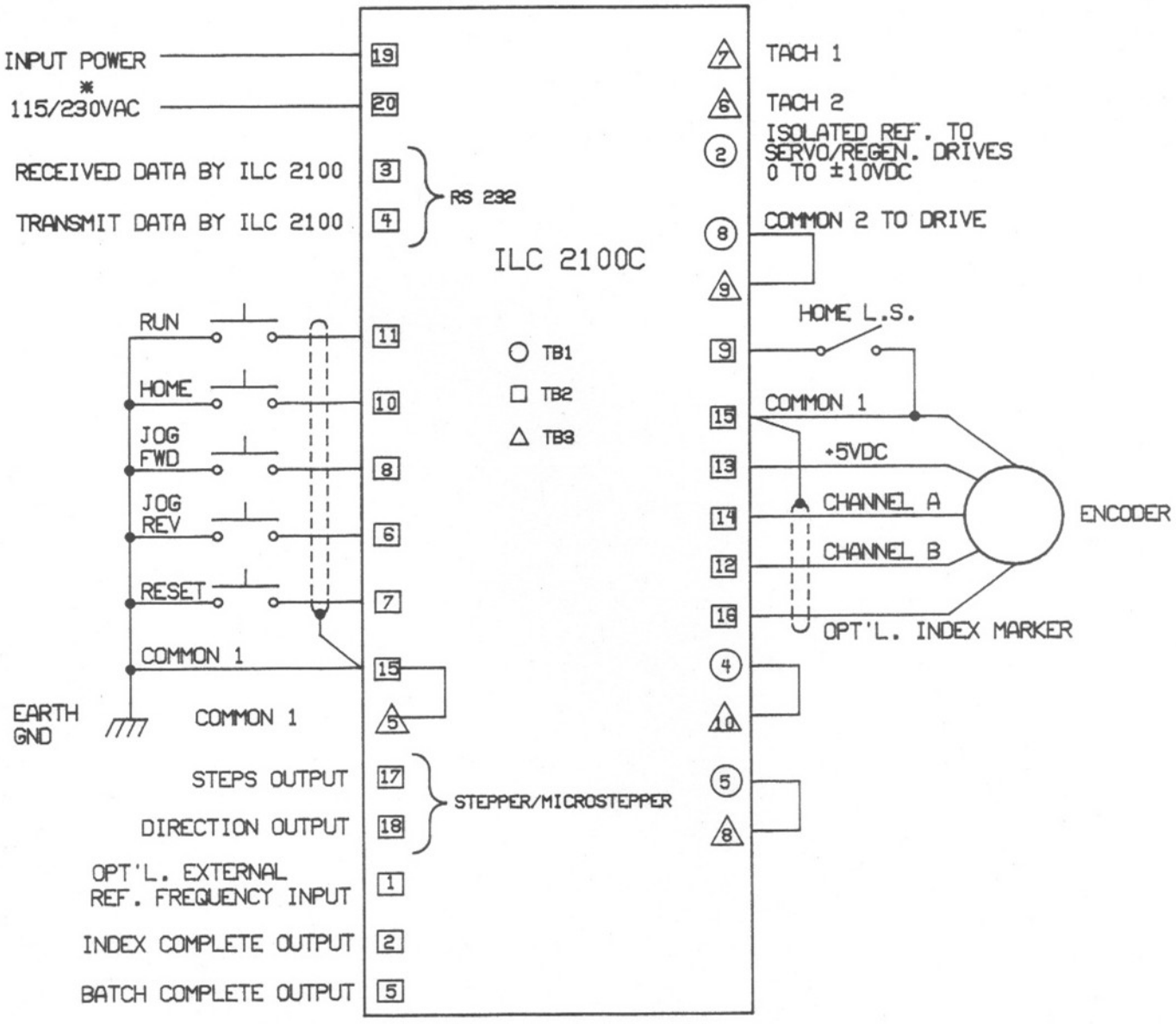
Introl Design, Inc. LOCKPORT, N.Y.

NO. 274-18

TITLE TYPICAL CONNECTION DIAGRAM ILC 2100C TO INTROL MODEL 482 REGENERATIVE DRIVE

	DESCRIPTION	DATE	APPVD.
	REVISIONS		

ERS	1-7-92		
DRAWN	DATE	CHKD.	APPVD.



NOTE:

1. ILC 2100 IS FACTORY SET FOR 115VAC. FOR 230VAC, REFER TO MANUAL.

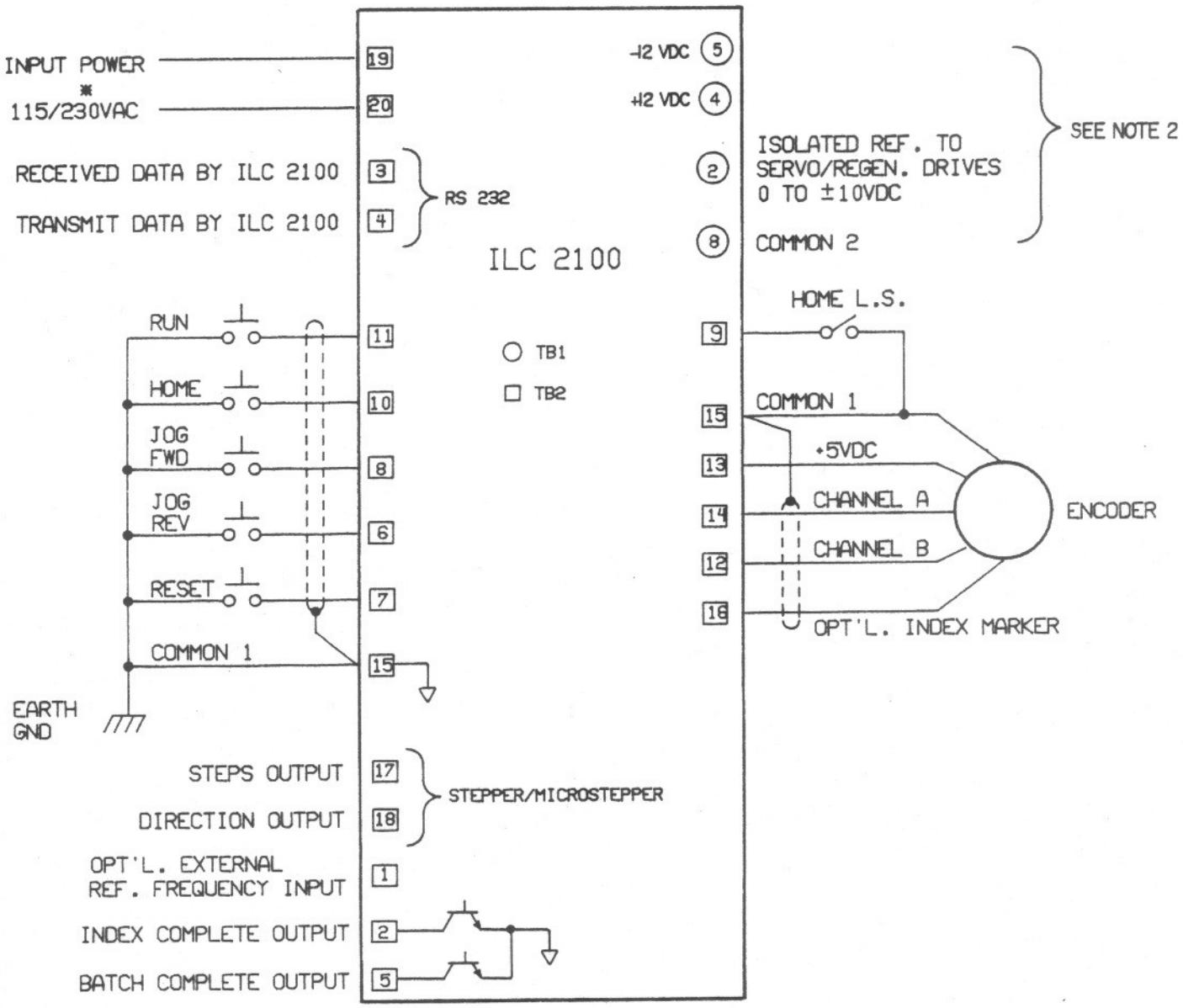
Introl Design, Inc. LOCKPORT, N.Y.

NO. 2100C-CCL

TITLE ILC 2100C CUSTOMER CONNECTION DIAGRAM WITH ELECTRONIC TACH. OPTION

	DESCRIPTION	DATE	APPVD.
REVISIONS			

ERS	8-25-89	Ali	Ali
DRAWN	DATE	CHKD.	APPVD.



NOTE:

*1. ILC 2100 IS FACTORY SET FOR 115VAC. FOR 230VAC, REFER TO MANUAL.

2. TB I TERMINALS ARE ELECTRICALLY ISOLATED FROM TB 2 TERMINALS

A	TB I ⑤ 8 ④ NOTE 2 ADDED	5/17/91	Ali
	DESCRIPTION	DATE	APPVD.
REVISIONS			

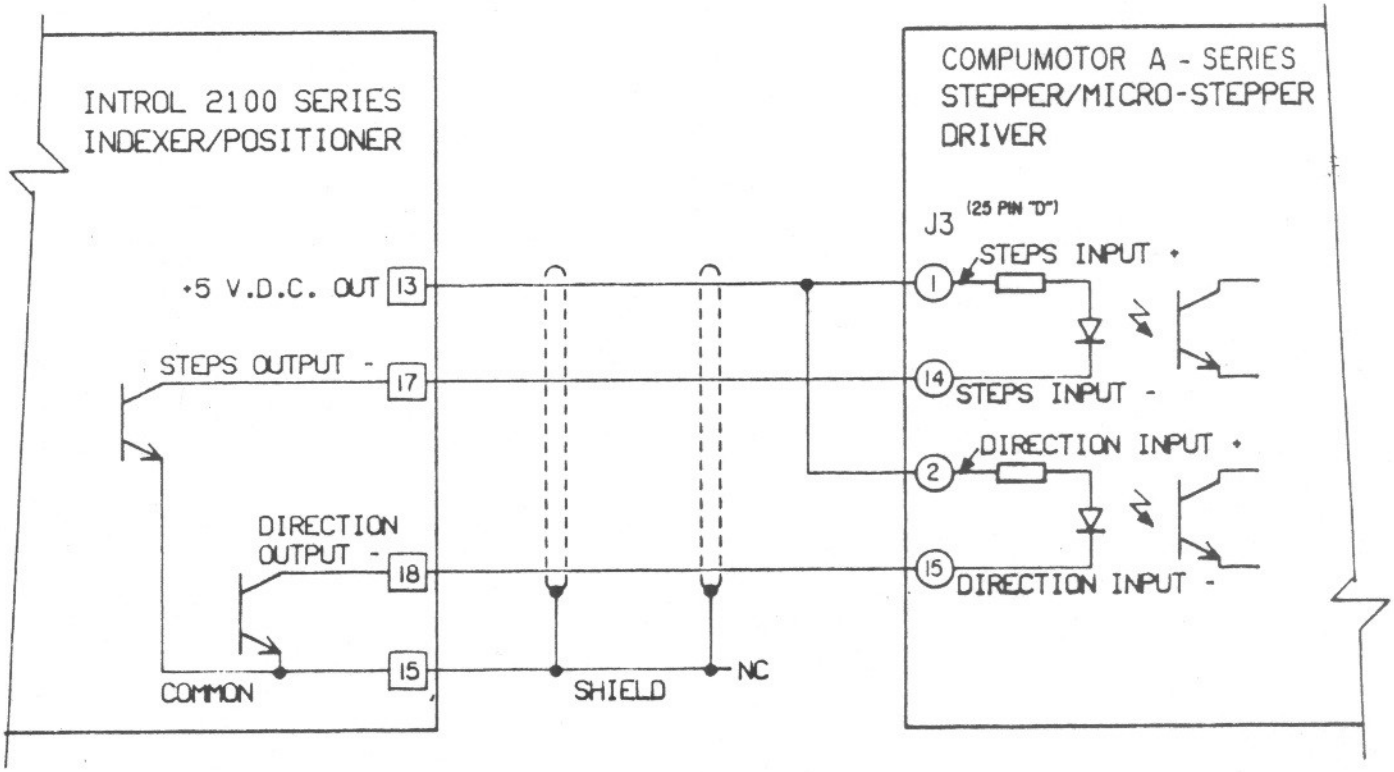
Introl Design, Inc. LOCKPORT, N.Y.

NO. 2100-CC

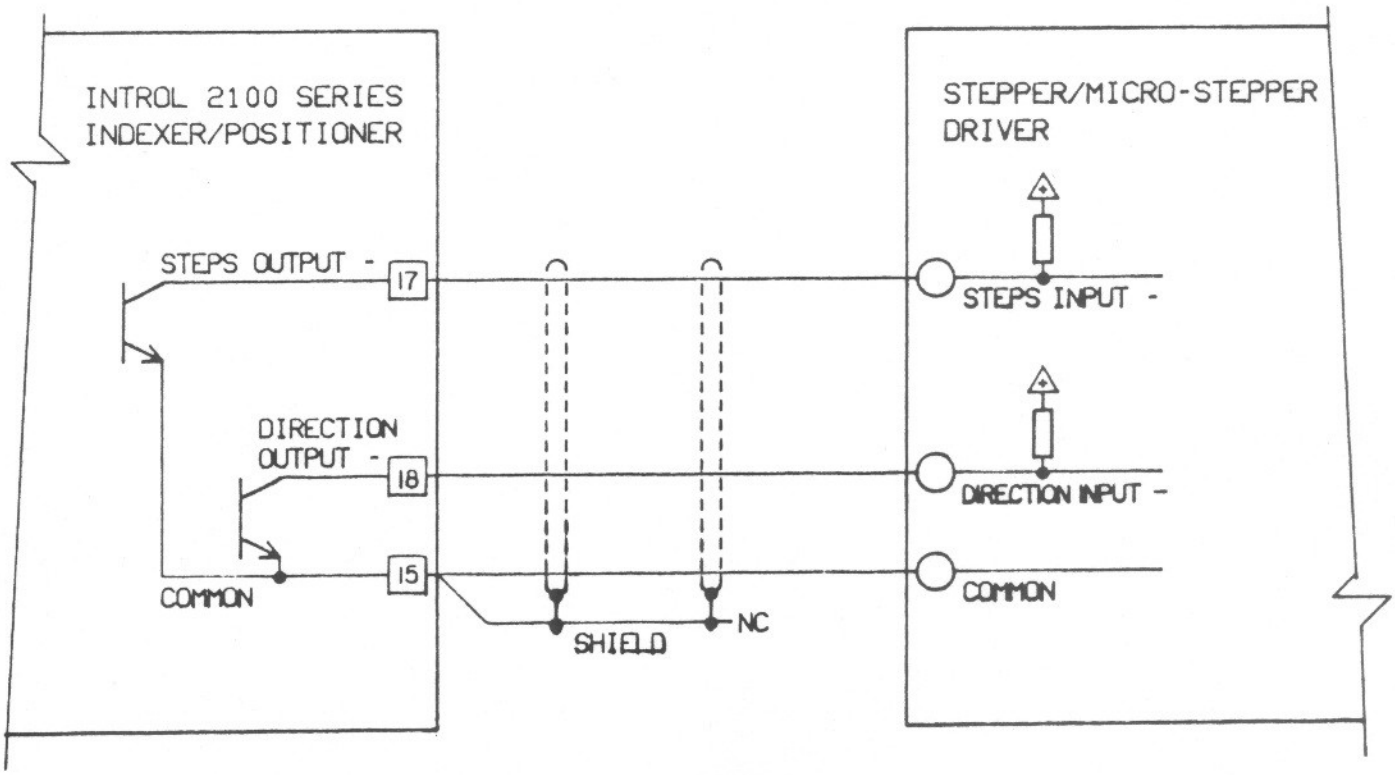
TITLE ILC 2100 CUSTOMER CONNECTION

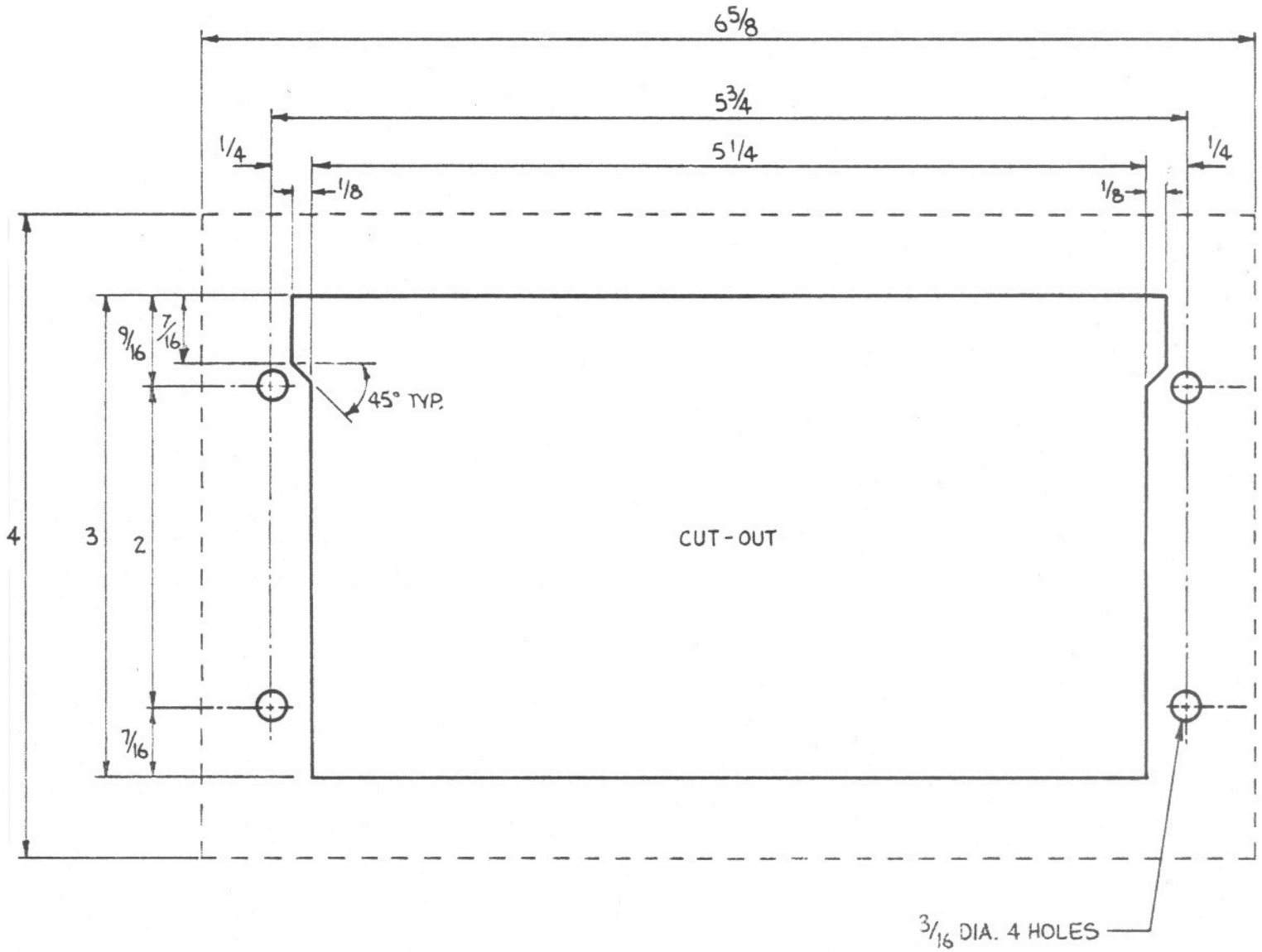
GP	4-13-88	Ali	Ali
DRAWN	DATE	CHKD.	APPVD.

WIRING DIAGRAM - INTROL 2100 SERIES TO STEPPER/MICRO-STEPPER DRIVER WITH OPTO-ISOLATOR INPUTS



WIRING DIAGRAM - INTROL 2100 SERIES TO STEPPER/MICRO-STEPPER DRIVER





NOTES:

1. ALL DIMENSIONS IN INCHES.
2. DOTTED LINE REPRESENTS OUTSIDE EDGE OF FRONT BEZEL.

	DESCRIPTION	DATE	APPVD.
A	CUT-OUT WAS 5 3/8 x 3 RECTANGLE.	6-16-87	

REVISIONS

Introl Design, Inc. LOCKPORT, N.Y.

NO. 2100-02

TITLE PANEL CUT-OUT DIMENSION DRAWING FOR 2100

ERS	4-3-85		
DRAWN	DATE	CHKD.	APPVD.

WARRANTY POLICY

Introl Design, Inc. guarantees its products against defects in workmanship and materials for a period of twelve (12) months from date of purchase, not to exceed twenty-four (24) months from date of manufacture. Final determination of whether a device is defective rests with Introl Design. Introl Design must be notified about any alleged defects, and will provide the customer with shipping instructions. If inspection reveals defects caused by faulty materials or workmanship, Introl reserves the right either to rebuild the device using new or refurbished and warranted parts or to replace the device with a new device, returning to the buyer a device meeting full factory standards for new performance. Any repairs necessary due to customer modification will be considered non-warranty and billed by the factory at current rates. Buyer will bear costs of transportation to and from the factory, risk of loss for goods not at the factory, and costs required to remove or prepare for shipment and to reinstall equipment after repair. Introl Design, Inc. assumes no responsibility for injuries or damages to persons or property arising out of improper use of this device, and Introl Design's liability arising out of the device or its use, whether on warranty or otherwise, shall not exceed the cost of correcting defects. There are no expressed or implied warranties of merchantability or fitness for a particular purpose that apply to this device. Introl Design, Inc. reserves the right to make changes or improvements in its products without incurring any obligation to make such changes or improvements in the similar products previously purchased.

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