



Absolute Encoder Module

Catalog Number 1771-DE

Introduction

Use this documentation update with the Absolute Encoder Module User's Manual, publication 1771-6.5.32 - January 1986. This documentation update revises that user manual. Keep this update with your user manual.

Use this documentation update in place of the 1771-6.5.32-DU1 - February 1993.

What This Document Contains

For this information:	Refer to page:
Updated Information	2
New Write-data Throughput Time	2
Electrostatic Discharge	3
Response to External Fault	3
Removing Power Before Installing or Removing the Module	4
Power Requirements	4
Offset Feature	4
Offset Words	7
Block-transfer Write Data with Offset	7
Block-transfer Read Data with Offset	8
Programming Considerations with Offset	10
European Communities (EC) Directive Compliance	12
Specifications	13
Additional Notes	14

Updated Information

Add the following information to Chapter 2 in the Compatible Encoders section on page 2-2:

Compatible Encoder Output Drivers

There are three types of compatible encoder output drivers:

- standard TTL or LSTTL gates (7400, 74LS04)
- open collector (7406, 74LS38)
- differential line driver (DM8830, 75ALS192)

These encoders do not cause overcurrent through the optocoupler. When an input is high, the photodiode receives current through the on-board pull-up resistor. When an input is low, the current flowing through the on-board pull-up resistor is shunted away from the photodiode and pulled to ground.

The following sections remain unchanged from the second Documentation Update 1.

New Write-data Throughput Time

Refer to the module specifications on page 2-6. The new write-data throughput time (worst case) is 4.7 ms.

The new write-data throughput time is the time between the end of a block-transfer-write operation and the module update of its outputs. The module's response time can vary, depending on the number of outputs it controls, the type of absolute encoder you use, and if you have an offset value. Use the following table to determine the module's response time in milliseconds for your application.

Type of Encoder (with or without offset):	Number of Outputs:			
	2	4	6	8
BCD without offset	1.2	1.8	2.5	3.1
BCD with offset	2.0	2.9	3.8	4.7
Gray code or binary without offset	1.3	2.0	2.6	3.3
Gray code or binary with offset	1.9	2.6	3.4	4.1

Electrostatic Discharge

Electrostatic discharge can damage integrated circuits or semiconductors in this module if you touch backplane connector pins. It can also damage the module when you set configuration plugs or switches inside the module. Avoid electrostatic discharge by observing the following precautions:

- touch a grounded object to discharge yourself before handling the module
- do not touch the backplane connector or connector pins
- when you configure and replace internal components, do not touch other circuit components inside the module. If available, use a static-safe work station.
- when not in use, keep the module in its static-shield bag

ATTENTION

Electrostatic discharge can degrade performance or damage the module. Handle as stated above.



Response to External Fault

Add the following paragraphs to Chapter 3, immediately before the section on Keying (page 3-4):

Except for downloading programs or commands and reporting status, the module operates independent of the host processor. In the event of a processor or I/O communications fault, the module either continues operation or its outputs turn off, depending on how you set the last state switch of the chassis in which you place the module.

If you set the last state switch to turn outputs off, the module's outputs are turned off.

If you set the last state switch to hold outputs in last state, the module continues operating.

Removing Power Before Installing or Removing the Module

Replace the first warning on page 3-11 with the following:

ATTENTION

Remove power from the 1771 I/O chassis backplane and wiring arm before installing or removing the module.



-
- Failure to remove power from the backplane or wiring arm could cause module damage, degradation of performance or injury
 - Failure to remove power from the backplane could cause injury and/or equipment damage due to possible unexpected operation

Power Requirements

Add this information to page 3-5:

ATTENTION

If multiple power sources are used, do not exceed the specified isolation voltage.



Offset Feature

Offset is a new feature of the Absolute Encoder Module (cat no. 1771-DE, rev. B). Revision A modules do not have this feature.

Offset is the difference between the 0 position of the absolute encoder and the 0 position of the machine shaft to which the encoder is connected. You can program this value to compensate for such factors as machine wear or improper mechanical setup. You do not have to disconnect your equipment to realign the 0 position of the machine shaft with the 0 position of the absolute encoder.

Determining the Offset Value

You can find the offset value using either of two equations, depending on whether you use the 0 machine position or the 0 encoder position as your reference.

To calculate an offset value from a 0 encoder position, use this equation:

$$N - M = S$$

where N = number of encoder positions, M= machine position at encoder 0, and S = offset.

To calculate an offset value from a 0 machine position, use this equation:

$$E - N = S$$

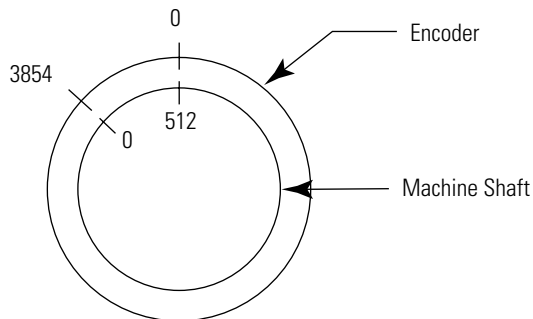
where E = encoder position at machine 0, N = number of encoder positions, and S = offset.

Here is an example of how to find the offset value with reference to 0 encoder position and 0 machine position. Assume the following:

- you have a 0 to 4095-position encoder (4096 positions)
- the machine shaft is at position 512 when the machine is at position 0
- the encoder is at position 3584 when the machine is at position 0

In this example, the 0 machine position is “ahead” of the 0 encoder position. Depending on which equation you use (your reference point), the offset value is either positive or negative.

Offset Value from 0 Encoder Position and from 0 Machine Position



At encoder position 0, machine shaft position is 512.
The offset is +3,584

At machine shaft position 0, encoder position is 3854.
The offset is -512.

13522-M

The equation (from 0 encoder position) is:

$$4096-512=3584$$

The offset is +3584

The equation (from 0 machine position) is:

$$3584-4096=-512$$

The offset is -512

You get the same result from programming either +3584 or -512.

Offset Words

Once you determine the offset value, you need to program two write-block transfer words. These are the last two words of the write-data block that you send to the absolute encoder module. Your program them in BCD, as you do the preset values.

Format of Offset Words

17	16	15	14	13	12	11	10	7	6	5	4	3	2	1	0	Bits
S	Offset Value															
No. of encoder positions																

The offset words are the last two words of the write-data block that you send to the absolute encoder module.

If you are controlling:	The offset words are:
2 outputs	words 6 and 7
4 outputs	words 11 and 12
6 outputs	words 16 and 17
8 outputs	words 21 and 22

S = sign bit. Set this bit if the offset has a negative value; reset the bit if the offset has a positive value.

13523-M

The first offset word contains the value of the offset. Bit 17 of this word is the sign bit. It indicates whether the offset is negative or positive. Set bit 17 if the offset is negative; reset it if the offset is positive.

The second offset word is the number of positions of the encoder. If you are using a 0 to 4095-position encoder, your second offset word is 4096.

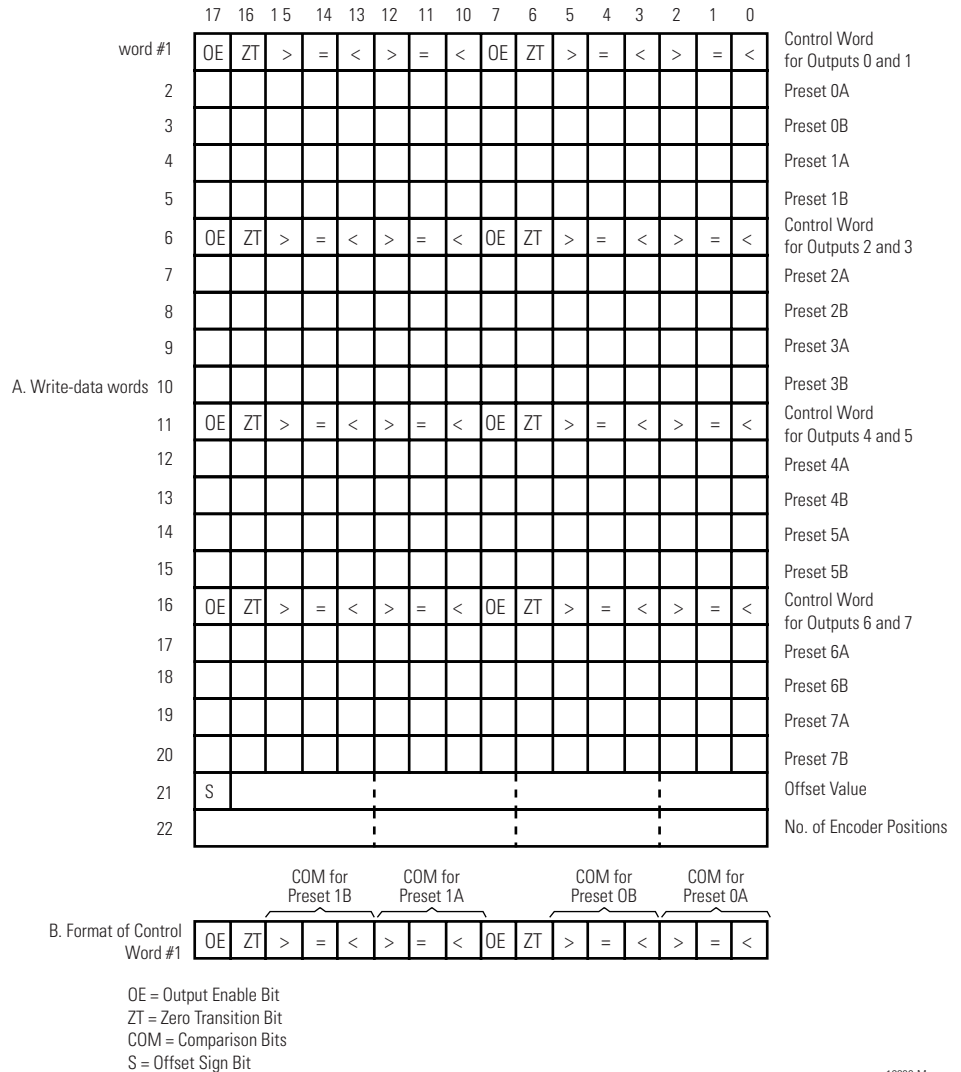
Block-transfer Write Data with Offset

The number of words you send to the module depends on the number of outputs the module controls. The offset feature adds two words to the total number of words you send to the module:

If the module controls:	You send:
2 outputs	7 words
4 outputs	12 words
6 outputs	17 words
8 outputs	22 words

If the module is controlling eight outputs, your block-transfer write data now looks like this:

Format of Block-transfer Write Data with Offset



12839-M

Block-transfer Read Data with Offset

The upper byte of word 1 indicates the status of the eight outputs controlled by the module. The module sets each bit when the corresponding output is turned on.

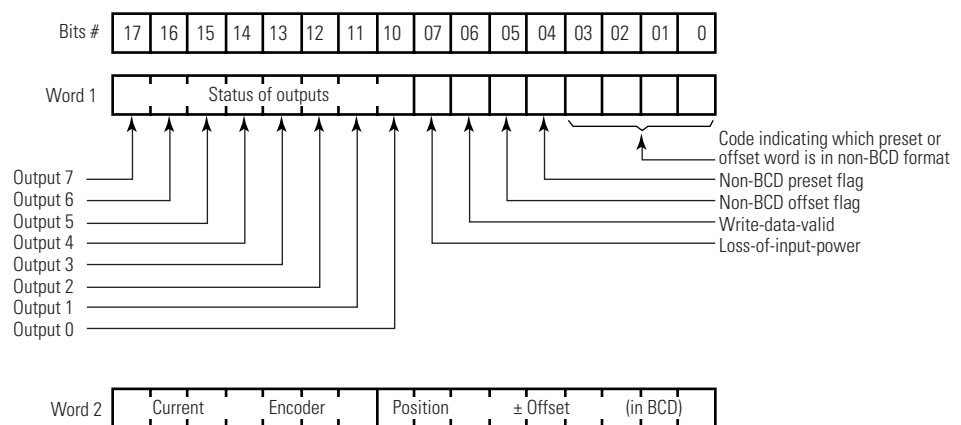
The lower byte of word 1 (by bit) is:

- bit 7 is the loss-of-input-power bit. It is set when input power is lost; it is reset when power is restored and bit 6 is reset
- bit 6 is the write-data-valid bit. It is set at power-up and when the processor changes from program mode to run mode; it is reset when the module receives valid data in a block-transfer write operation
- bit 5 is the non-BCD offset flag. See the description of bit 0 (below) to identify which offset word is in error
- bit 4 is the non-BCD preset flag. It is set when a preset word is in non-BCD format
- bits 3 thru 0 are a binary or hexadecimal code that indicates which preset word is not in BCD format. Refer to Appendix D of the User's Manual for the value of these bits.
- bit 0 identifies which offset word is in non-BCD format when bit 5 is also set
 - if bit 0 is set, the word containing the number of encoder positions is in error
 - if bit 0 is reset, the word containing the offset value is in error

The module identifies each non-BCD word in the order it finds them (one at a time). Once you correct the format of one word, the module continues to identify other non-BCD words.

Word 2 indicated the current position of the encoder, with the offset value in BCD.

Format of Block-transfer Read Data with Offset



13070-M

Programming Considerations with Offset

The default block lengths (00) for block-transfer instructions are 20 block-transfer write words and two block-transfer read words. These are the block lengths that transfer to and from the absolute encoder regardless of whether you use the offset feature.

For example, when you have an offset value and the module is controlling eight outputs, the number of words you send to the module is 22. You must enter the numbers 22 and 2 for the block lengths of write and read data. Do not enter the default block length in your instructions if you use the module's offset feature.

For PLC-2 family processors, do not enable the read-and-write block-transfers in the same scan when you use the offset feature. An example program enabling the instruction separate scans follows.

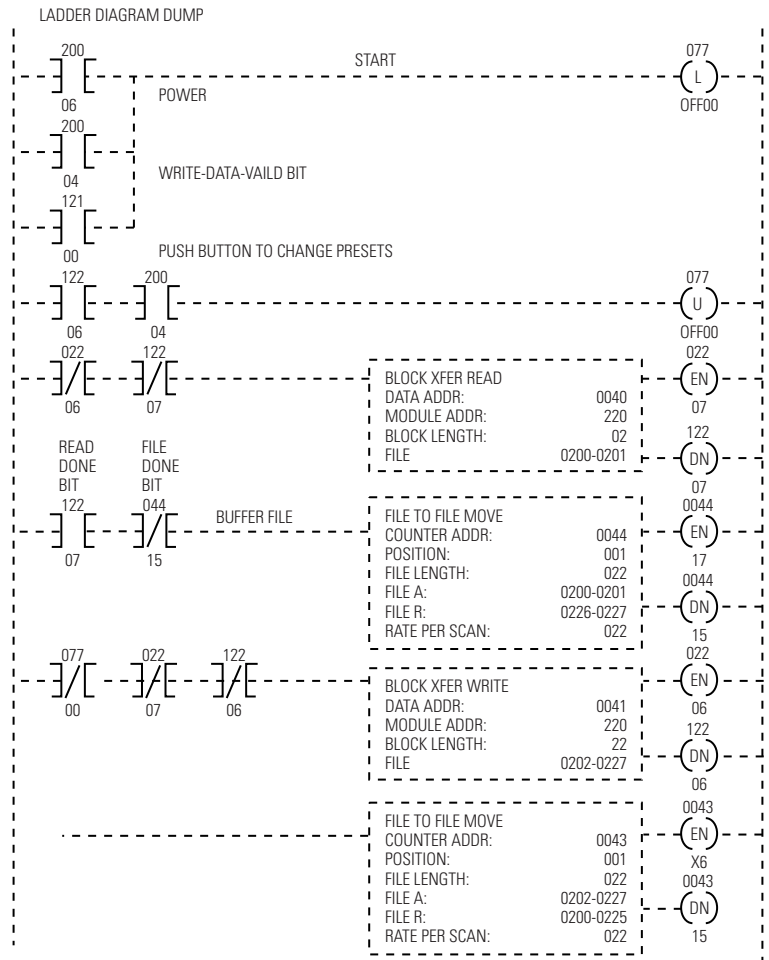
ATTENTION



When the block lengths of bidirectional block-transfer instructions are set to unequal value, do not enable the rung containing the alternate instruction until the done bit of the first transfer is set. If you enable them in the same scan:

- the number of words transferred may not be the number intended
- invalid data could be operated upon in subsequent scans
- output devices could be controlled by invalid data

Unexpected and/or hazardous machine operation could occur. Damage to equipment and/or injury could result.



31160-M

Rung 1	200/06 and 200/04 are returned in the read operation and latch 077/00. When 077/00 is latched, the module toggles between a read operation and a write operation. 121/00 is optional and lets the processor initiate a block-transfer write operation.
Rung 2	This rung examines the write-done bit (122/06) and the valid BCD data bit (200/04) to unlatch 077/00 and begin the read-only operation
Rung 3	This rung contains the block-transfer read instruction, conditioned by the read-done bit and the write-enable bit.
Rung 4	Use a file-to-file move to buffer the read data. Use addresses 0226 and 0227 when making any data comparisons.
Rung 5	This rung contains the block-transfer write instruction, conditioned by the write-done bit and the read-enable bit.
Rung 6	This rung is for display purposes only.

European Communities (EC) Directive Compliance

If this product has the CE mark it is approved for installation within the European Union and EEA regions. It has been designed and tested to meet the following directives.

EMC Directive

This product is tested to meet the Council Directive 89/336/EC Electromagnetic Compatibility (EMC) by applying the following standards, in whole or in part, documented in a technical construction file:

- EN 50081-2 EMC — Generic Emission Standard, Part 2 — Industrial Environment
- EN 50082-2 EMC — Generic Immunity Standard, Part 2 — Industrial Environment





This product is intended for use in an industrial environment.

Low Voltage Directive

This product is tested to meet Council Directive 73/23/EEC Low Voltage, by applying the safety requirements of EN 61131-2 Programmable Controllers, Part 2 - Equipment Requirements and Tests. For specific information required by EN 61131-2, see the appropriate sections in this publication, as well as the Allen-Bradley publication Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

Open style devices must be provided with environmental and safety protection by proper mounting in enclosures designed for specific application conditions. See NEMA Standards publication 250 and IEC publication 529, as applicable, for explanations of the degrees of protection provided by different types of enclosures.

Specifications

Module Location	Any 1771 I/O chassis; any 2-slot I/O group
Inputs	
Input Power Supply	+5V DC @ 300 mA
Number of Inputs	Up to 12 encoder input bits per module
Input Voltage Range and Logic State	Logic 1:2.4V to 5.0V DC Logic 0:0.0V to 0.6V DC
Input Current per Channel (sunk by encoder device)	11 mA for single-ended drivers 18 mA for differential drivers
Backplane Power	5V DC @ 800 mA
Maximum Input Frequency	50 KHz
Encoder Data Settling Time	100 ns
New Position Throughput Time	200 μ s
New Write-data Throughput Time	3 ms
Encoder Formats	BCD Natural Binary Standard Gray
Digital Resolution	Up to one part in 4,095 with natural binary and standard Gray encoders Up to one part in 999 with BCD encoders
High-true Logic	From totem pole, open collector, or differential line drivers Can select direction of rotation of increasing position of Gray encoders
Outputs	
Output Power Supply	Selectable: +5 to +24V DC @ 16A maximum
Number of Outputs	8
Output Rating	2A sourced per output (no derating with all outputs on)
VA Rating	48W per output 384W per module
Surge Rating	4A for 10ms
Output Fuses	250V 3A rectifier fuses (Littelfuse 322003, Buss GBB003 or equivalent)
General	
Input and Output Isolation	Tested to 850V DC for one second
Environmental Conditions	Operating Temperature - 0 to 60°C (32 to 140°F) Storage Temperature - 40 to 85°C (-40 to 185°F) Relative Humidity - 5 to 95% (without condensation)
Keying (for slot 0 only)	Between 2 and 4 Between 26 and 28
Agency Certification (when product is marked)	 Listed Industrial Control Equipment Certified Process Control Equipment  Certified Class I, Division 2, Group A, B, C, D  Marked for all applicable directives  Marked for all applicable acts N223

Additional Notes

The module must be mounted within a suitable enclosure to prevent personal injury resulting from accessibility to live parts. The interior of this enclosure must be accessible only by the use of a tool.

This industrial control equipment is intended to operate in a Pollution Degree 2 environment, in overvoltage category II applications, as defined in IEC publication 664A, at altitudes up to 2000 meters without derating.

PLC-2 is a trademark of Rockwell Automation.

Notes

Reach us now at www.rockwellautomation.com

Wherever you need us, Rockwell Automation brings together leading brands in industrial automation including Allen-Bradley controls, Reliance Electric power transmission products, Dodge mechanical power transmission components, and Rockwell Software. Rockwell Automation's unique, flexible approach to helping customers achieve a competitive advantage is supported by thousands of authorized partners, distributors and system integrators around the world.

Americas Headquarters, 1201 South Second Street, Milwaukee, WI 53204, USA, Tel: (1) 414 382-2000, Fax: (1) 414 382-4444
European Headquarters SA/NV, avenue Herrmann Debroux, 46, 1160 Brussels, Belgium, Tel: (32) 2 663 06 00, Fax: (32) 2 663 06 40
Asia Pacific Headquarters, 27/F Citicorp Centre, 18 Whitfield Road, Causeway Bay, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Publication 1771-DU032B-EN-P - November 2000

Supersedes Publication 1771-6.5.32-DU1 - February 1993



**Rockwell
Automation**

PN 957445-32

© 2000 Rockwell International Corporation. Printed in the U.S.A.