INTRODUCTION

The CHI Asynchronous Communications Adaptor (ACA) provides, a flexible means of two way point to point data transfer for the CHI 2130 or IBM 1130. Each ACA is one card that provides one line. Systems may be configured with up to 15 or more lines. The ACA operates under normal program control.

There are three modes of electrical transmission available. Systems may be configured with any combination of the three. The modes are, current loop for devices such as teletypes, RS-232 for telephone data sets, and balanced line for low transmission error rates in noisy environments.

Cable length for current loop operation may be several thousand feet at the lower baud rates. RS-232 operation can be accomplished with cables up to 100 ft. long, however, some types of data sets limit the cable to 50 ft. Balanced line cable length can be 1000 ft. maximum at all baud rates.

Receiving Data

When the program expects to receive data, several conditions must first be checked. The data carrier detect indicator must be on and in RS-232 mode the data set ready indicator must also be on. If these conditions are not met the program should arm the interrupts from the indicators that are false and wait for the interrupts. As soon as all conditions are correct the program should; (1) reset the UART; (2) condition the line and (3) arm the read response interrupt.

Each time a data word is deserialized and transferred to the receiver holding register the read response interrupt may be set. When responding to this interrupt the program should keep track of the framing error bit in the Secondary DSW as specified in the Break description. If the program determines that an interrupt is due to a read response an XIO read command should always be given whether or not the data will actually be used. If bit 15 of the read data word is on that received data word and possibly the one before and after it is in error and cannot be considered useful.

The program should always be able to recover from a missing interrupt of any kind. The amount of time allowed before an interrupt is considered missing, will vary with the type of interrupt and system configuration.

Transmitting Data

When the program is ready to transmit data the UART should be reset and the line conditioned. In RS-232 mode the data set ready indicator should be on. The request to send bit should be turned on and the clear to send interrupt armed. As soon as clear to send comes true transmission may begin. In some full duplex hookups request to send may be held on constantly and it is only necessary to make sure clear to send is true before beginning transmission. In current loop and balanced line mode the data carrier detect is the only indicator that needs to be on before beginning transmission.

To begin transmission the program must arm the write response interrupt and issue an XIO write command for the first word to be sent. Each time the ACA is ready to accept a new word for transmission a write response interrupt may be set. When responding to this interrupt the program should keep track of the framing error bit in the Secondary DSW as specified in the Break description.

At the end of a message the write response should be disarmed after the write response following the write command for the last word to be sent. Then in RS-232 mode and half duplex current loop mode the transmit register empty interrupt should be armed. In RS-232 mode at least 4 milliseconds should be allowed after the transmit register empty

interrupt before turning off request to send. In half duplex current loop mode it is not possible to receive data until after the transmit register empty interrupt.

The program should always be able to recover from a missing interrupt of any kind. The amount of time allowed before an interrupt is considered missing will vary with the type of interrupt and system configuration.

Break Description

A break is defined as the receive line being held in the space condition for 0.35 seconds or longer. Break can be used to gain attention of the remote station during data transmission or receipt.

Break is generated in the ACA with a line conditioning bit. The leading edge of break may be detected by one read response with the framing error bit on in the DSW. In systems with a manual break key, contact bounce will cause parity errors also. When a break condition occurs there will not necessarily be any continuing read responses.

In half duplex hookups data transfer is not possible during break. When the beginning of a break condition is established by the program the ready or write responses should be disarmed and the end of break interrupt should be armed. When this interrupt occurs normal system operation can resume.

In full duplex hookups read responses should be disarmed during a break since the receiver circuitry will continue to deserialize faulty words.

When an ACA is neither receiving nor transmitting data the read response should be armed. This enables the program to sense a break condition.

PROGRAM CONSIDERATIONS

Line Set Up

Conditioning of a communications line for proper operation is accomplished with an XIO control, modifier 0, command. This should be done prior to the beginning of each message transmission or receipt.

The XIO control, modifier 0, command may be issued at any time as long as the state of certain bits as noted is not changed while transmitting or receiving data. Each condition is established when its appropriate bit is a one in the XIO and the condition is removed whenever its bit is zero.

Bit 0, Request To Send - Used as a data set control in the RS-232 mode only. A one in this position will cause the data set to return clear to send after a delay. Request to send must be held on during the entire message transmission and should not be turned off until at least 4 milliseconds following the transmitter empty interrupt. In full duplex operation with some data sets, request to send may be left on all the time.

Bit 1,Enable Echo of Received Data - Allows incoming serial data to be retransmitted.

Bit 2,Force Break - A one in this position forces the transmitted data line to the space condition. This condition should be held for a minimum of 0.35 seconds.

Bit 3,Parity Inhibit - This bit when true prevents the generation or checking of parity.

Bit 4,Parity - This bit selects the parity to be generated or checked when Bit 3 is off. A zero selects odd parity and a one selects even parity.

Bit 5,Stop Bit - A zero selects one stop bit and a one selects two stop bits.

Bit 6 & 7,Word Length Select - Sets the length of the data word exclusive of start, stop and parity bits. See chart for proper setting.

Bits 8, 9 10, & 11,Baud Rate Select - See Chart for proper settings.

Bit 12, Supervisory Transmit Data - Used as a data set control in the RS-232 mode only and when the data set is equiped with a reverse channel. When used this bit is normally kept on. It is turned off to notify the remote data terminal of some condition.

Bit 13,Data Terminal Ready - Used for automatic answer and termination of calls in RS-232 mode only. If ring interrupt is not armed this bit should always be on. Otherwise this bit is turned on when a ring interrupt is received and held on for the entire duration of the call. To terminate a call it must be turned off for a minimum of 50 milliseconds.

Bit 14,Unused

Bit 15,Reset UART - May be used to clear the receiver - transmitter circuitry. Should always be followed by a second XIO control, modifier 0, command to re-establish proper line set up.

Interrupt Set Up

The ACA can be set up to operate with one or two interrupt levels. When using two interrupt levels the read response is assigned to the higher priority level. Jumper selection provides operation on interrupt levels 0,1,2,3, or 4 in the CHI 2130. The ACA can operate only on interrupt levels 2,3, or 4 in a CHI 1144 on an IBM 1130.

Read response may be jumpered to cause an interrupt on any one of the following levels; 0,1,2,3, or 4. Read response has its own individual ILSW bit which may be jumpered to any one of the sixteen available bits.

All of the rest of the interrupting conditions may be jumpered as a group to cause interrupts on level 0,1,2,3, or 4. These interrupting conditions as a group have an individual ILSW bit that may be jumpered to any one of the sixteen available bits.

All interrupts from each ACA line may be masked with an XIO control, modifier 1, command without regard to whether or not they are armed. Upon powerup of the system and after the master reset button is pushed all ACA lines are masked. Each line may be unmasked by an XIO control, modifier 2, command. If any conditions that were armed came true during the masked state; the interrupt will be presented to the CPU immediately after the unmask command. Note that mask/unmask and arm/disarm are two different kinds of interrupt control.

Each of nine status conditions may be individually armed, to cause an interrupt at the beginning of the true condition. Interrupt arming is accomplished with an XIO control, modifier 3, command. Each time the command is given the bits that are a one will arm the associated condition. The bits that are zero will disarm their conditions. If an interrupt is pending from an armed condition it is possible to disarm the condition without losing the interrupt. Note that arm/disarm and mask/unmask are two different kinds of interrupt control.

Interrupt Servicing

When an interrupt occurs it is necessary to determine what device is causing it. An XIO sense interrupt command will interrogate all devices or groups of devices with interrupts on the same level. The Interrupt Level Status Word returned will have an individual bit or set of bits on for each device or group of devices that is causing an interrupt on the level being serviced at that moment.

Systems will be configured with several ACA lines grouped under one area code. There will only be one or two ILSW bits for these lines, therefore it will be necessary to do a further sense operation to distinguish which line of the group is causing the interrupt. An XIO sense device, group 0, command will interrogate all lines under a single area code. Each ACA line with a pending interrupt will present an individual bit in the position equivalent to the decimal value of its group address. This is referred to as the Primary Device Status Word. Note that bits 14 and 15 are used to distinguish between read response interrupts and all other interrupts.

After the area and group code is determined the interrupting condition is found by doing an XIO sense device command with the appropriate group code. This is referred to as the Secondary Device Status Word. Note that bit 15 only allows the reset of the read response interrupt and that bit 14 allows the reset of all other interrupts.

Bit 0,Read Response Interrupt - Can only be turned on when armed. Indicates that a received word has been transferred to the receiver holding register and may be read.

Bit 1,Write Response Interrupt - Can only be turned on when armed. Indicates that the last word written to an ACA line has been transferred from the holding register to the transmit register and a new word may be written.

Bit 2,Clear to Send - Used in the RS-232 mode only. Indicates that the data set is prepared to handle transmitted data. The leading edge of this condition will cause an interrupt only if armed.

Bit 3,Transmit Register Empty Interrupt - Can only be turned on when armed. Indicates that the last word has been completely transmitted and there are no words left in the holding or transmit registers.

Bit 4,End of Break Interrupt - Can only be turned on when armed. Indicates that the received data line has returned to a mark condition after being at a space condition for more than 0.25.

Bit 5,Ring Interrupt - Can only be turned on when armed in RS-232 mode. Indicates that the data set has received a ringing signal.

Bit 6,Data Set Ready - Used in RS-232 Mode only. Indicates that the local data set is ready to handle data transfer. The leading edge of this condition causes an interrupt only if armed.

Bit 7,Data Carrier Detect - Used in all modes to indicate that the received data line is in a condition to handle data. When armed the leading edge of this condition will cause an interrupt.

Bit 8,Supervisory Received Data - Used in RS-232 mode when the data set is equiped with a reverse channel. Indicates a space condition. The leading edge of a space will cause an interrupt if armed.

Bit 9 - 13, Unused

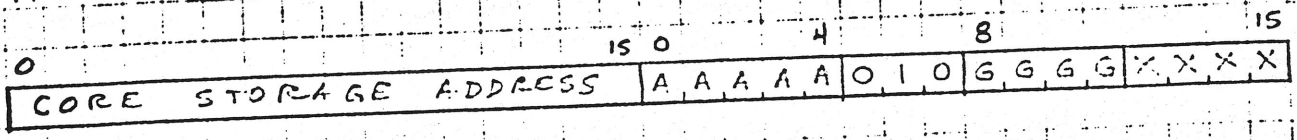
Bit 14,Framing Error - Indicates that the last word received did not have a proper stop bit. Used in determining the presence of an incoming break. Noninterrupting.

Bit 15, Unused

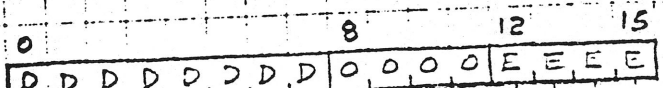
SYNCHRONOUS COMMUNICATIONS ADAPTER

IOCC'S

READ



DATA WORD

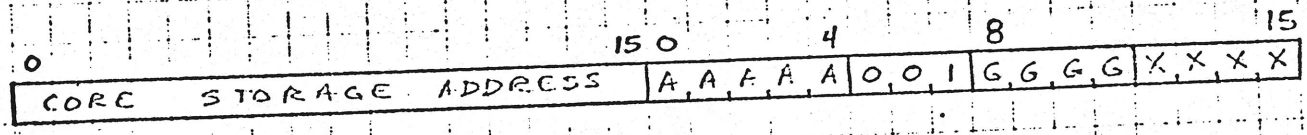


LAST BITS RECEIVED, ONE OR MORE STARTING WITH BIT "0" WILL BE ZERO IF WORD LENGTH IS LESS THAN 8 BITS.

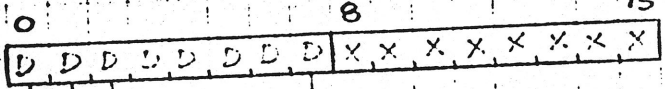
FIRST BIT RECEIVED

OVERRUN ERROR
PARITY ERROR
FRAMING ERROR
ANY ERROR

WRITE



DATA WORD



LAST BITS TRANSMITTED, ONE OR MORE BITS STARTING WITH "0" WILL BE IGNORED IF WORD LENGTH IS LESS THAN 8 BITS.

FIRST BIT TRANSMITTED

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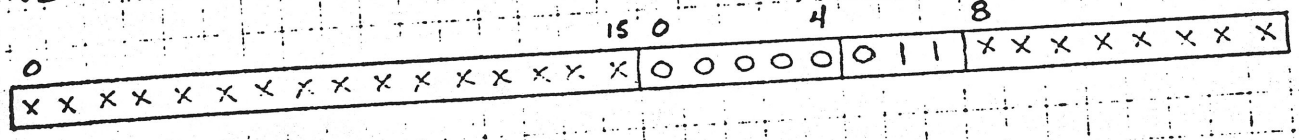
SYNCHRONOUS COMMUNICATIONS ADAPTER

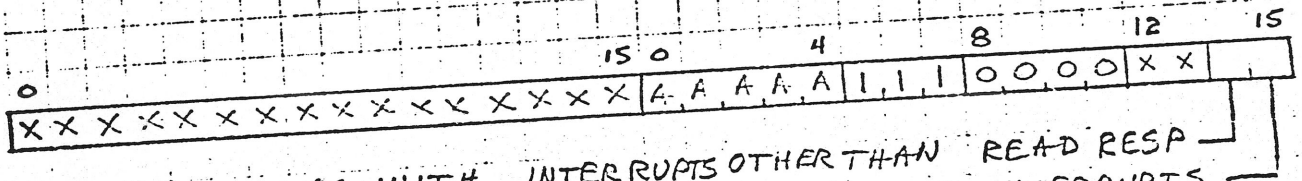
IOCC'S

SENSE INTERRUPT



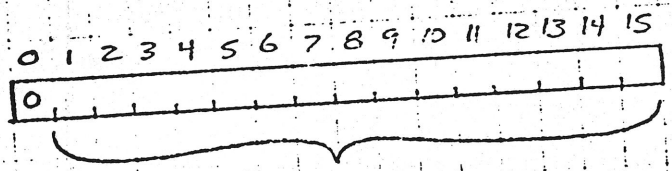
THERE ARE TWO SEPARATELY JUMPER SELECTABLE ILSW BITS, ONE FOR THE READ RESPONSE, THE OTHER FOR ALL OTHER INTERRUPTING CONDITIONS

SENSE DEVICE - PRIMARY (TO DETERMINE WHITCH GROUP AN INTERRUPT IS COMING FROM)



BITS 14 AND 15 MAY BE ON SIMULTANEOUSLY ONLY WHEN A SINGLE INTERRUPT LEVEL IS USED

PRIMARY DEVICE STATUS WORD

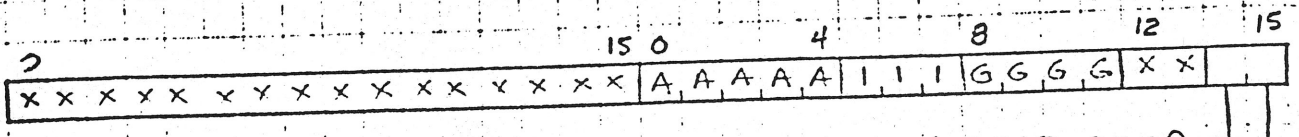


EACH BIT INDICATES AN INTERRUPT FROM THE GROUP OF THE SAME NUMBER.

SYNCHRONOUS COMMUNICATIONS ADAPTER

10CC'S

SENSE DEVICE - SECONDARY

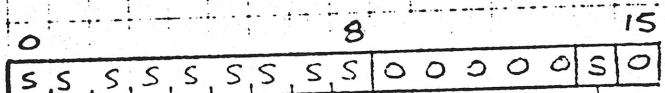


RESETS INTERRUPTING CONDITIONS OTHER THAN READ RESP

RESETS READ RESPONSE

BITS 11 AND 15 MAY BE ON SIMULTANEOUSLY ONLY WHEN A SINGLE INTERRUPT LEVEL IS USED

SECONDARY DEVICE STATUS WORD



BIT	INDICATES
0	READ RESPONSE INT
1	WRITE RESPONSE INT
2	CLEAR TO SEND INT OR CONDITION
3	TRANSMIT REGISTER EMPTY INT
4	END OF BREAK INT
5	RING INT
6	DATA SET READY INT OR CONDITION
7	DATA CARRIER DETECT INT OR CONDITION
8	SUPERVISORY RECEIVED DATA INT OR SPACE CONDITION
14	FRAMING ERROR

READ RESPONSE CAN BE JUMPERED TO CAUSE AN INTERRUPT ON LEVEL 0, 1, 2, 3, OR 4.

THE REST OF THE INTERRUPTING CONDITIONS CAN BE JUMPERED AS A GROUP TO CAUSE INTERRUPTS ON LEVEL 0, 1, 2, 3, OR 4.

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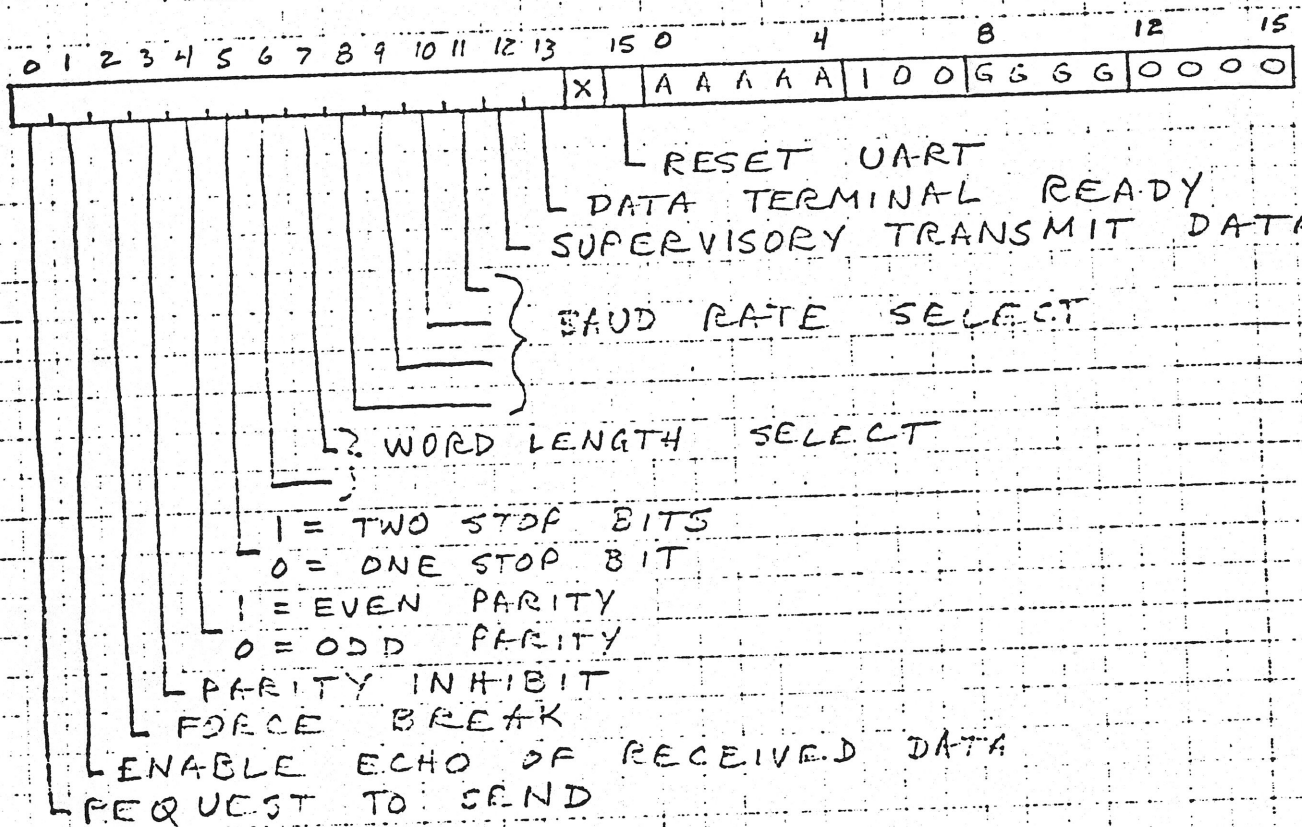
ASYNCHRONOUS COMMUNICATIONS ADAPTER

10CC'S

CONTROL - LINE SET UP



THE VALUE OF BITS 3 THRU 11 SHOULD NOT BE CHANGED WHILE TRANSMITTING OR RECIEVING DATA

BAUD RATE SELECT

BITS 8,9,10,11	
0 0 0 1	50
0 0 1 0	75
0 0 1 1	110
0 1 0 0	134.5
0 1 0 1	150
0 1 1 0	300
0 1 1 1	600
1 0 0 0	900
1 0 0 1	1200
1 0 1 0	1800
1 0 1 1	2400
1 1 0 0	3600
1 1 0 1	4800
1 1 1 0	7200
1 1 1 1	9600

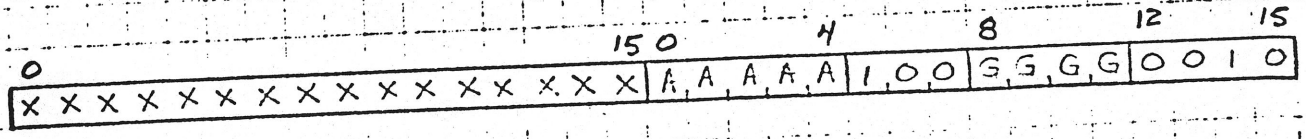
WORD LENGTH SELECT

BITS 6,7	
0 0	5 BITS
0 1	6 BITS
1 0	7 BITS
1 1	8 BITS

ASYNCHRONOUS COMMUNICATIONS ADAPTER

IOCC'S

CONTROL - MASK

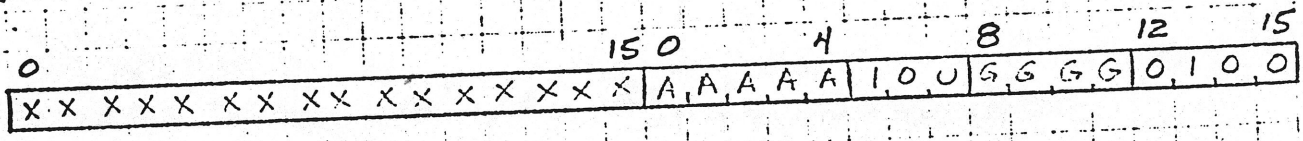


INHIBITS ALL INTERRUPTS FROM BEING PASSED ON TO THE CPU.

SHOULD NOT BE GIVEN TO A DEVICE THAT HAS INTERRUPTS PENDING.

DOES NOT PREVENT ARMED DSW BITS FROM BEING SET.

CONTROL - UNMASK

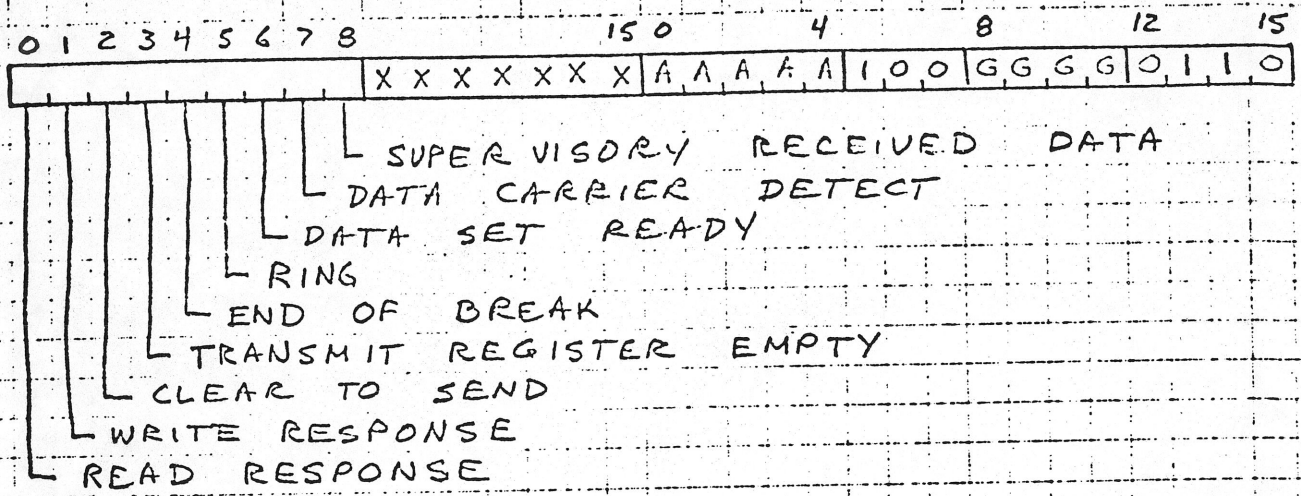


ENABLES INTERRUPTS FROM ANY DSW BITS THAT HAVE BEEN OR WILL BE SET

ASYNCHRONOUS COMMUNICATIONS ADAPTER

IOCC'S

CONTROL = ARM INTERRUPT



A ONE IN THE APPROPRIATE BIT POSITION WILL ALLOW THE TRANSITION, OF THAT INDICATOR, FROM FALSE TO TRUE TO SET AN INTERRUPT CONDITION WITHIN THE ADAPTER. THE INTERRUPT CAN BE PASSED ON TO THE CPU ONLY WHEN THE ADAPTER IS UN MASKED

SYMBOLS USED IN IOCC'S

A - DEVICE AREA CODE
D - DATA
E - ERROR CONDITION
G - DEVICE GROUP CODE
S - STATUS
X - UNDEFINED