

AQR 4 Phase Modulator

**2 CH and 3 CH Version
Technical manual**

Version 005

BRUKER

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This manual was written by

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© February 4, 1997: Bruker Elektronik GmbH

Rheinstetten, Germany

P/N: Z31225

DWG-Nr: 896005

Contents

	Contents	iii
	Index	5
1	Overview	7
2	Hardware	9
2.1	General	9
2.2	Digitalsection	9
	CPU	9
	Reset and Wake Up signal	9
	Decoder	10
	DAC Controlling	10
	I ² C E ² Prom	10
	SBS-Bus Interface	10
2.3	Analogsection	11
	DA-Converter	11
	Analog switch	11
3	Software	13
3.1	General	13
3.2	3.1. Boot firmware	13
3.3	3.2. Application firmware	13
4	Connector Pinout.....	15
4.1	Control Out	15
4.2	Control In	16
4.3	SBS Slave	17
A	PAL Listings	19
B	Schematics	25
	Figures	37
	Tables	39

Index

A

application firmware 13

B

BBIS 10

boot firmware 13

C

Comand interpreter 13

COS 11

D

DAC 10 – 11

downloading 9, 13

E

E2Prom 10

F

Flash Eprom 9

H

HPCU keyboard 7

I

I2C 10

M

microcontroller 9

P

PGMODE 10, 13

R

Receiver Phase.....	11
RS232	10
RS485	10

S

SBS-Bus Interface.....	7, 10
SE451	7
SIN	11
Sleep Mode	10

W

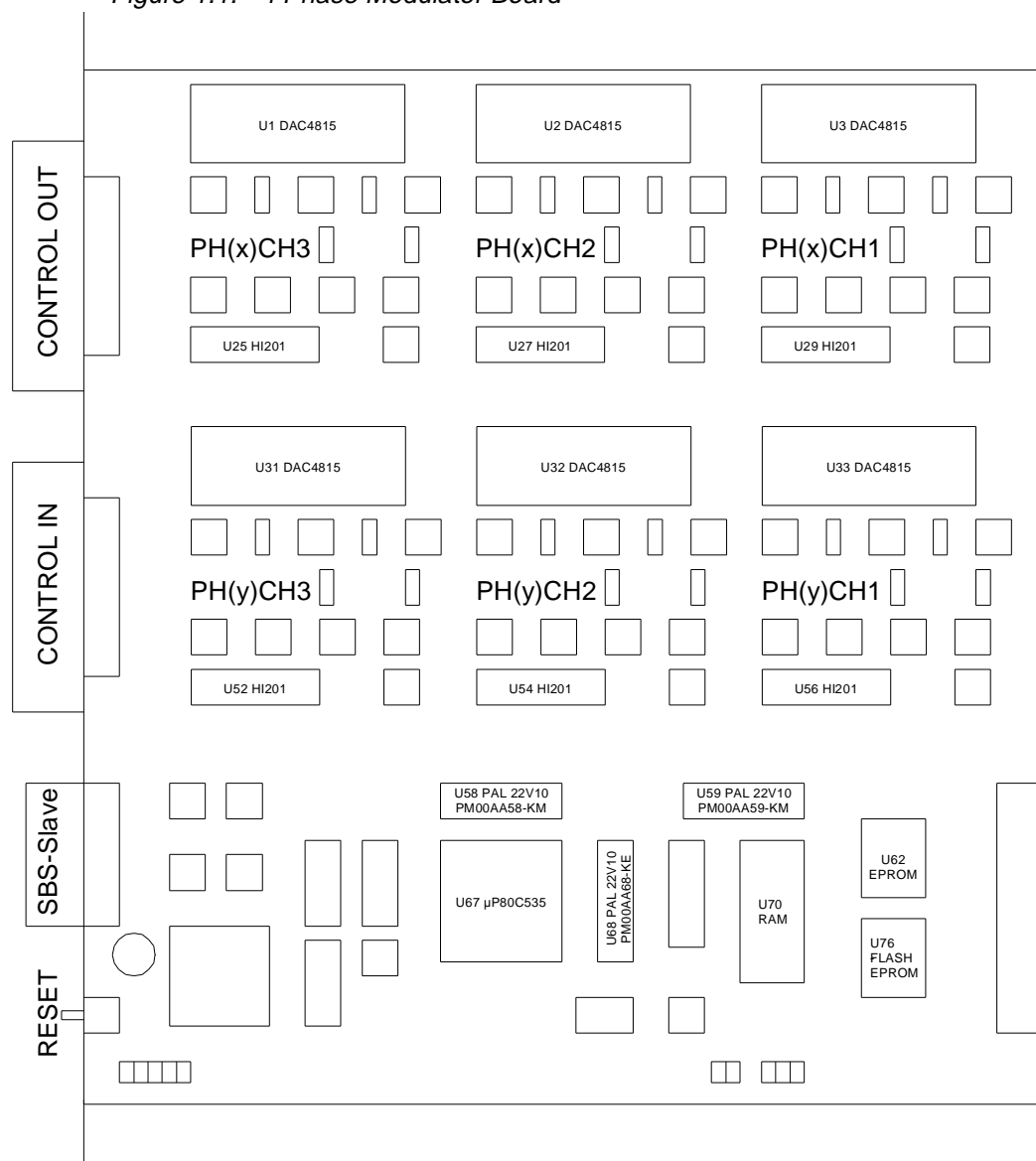
Wake Up	10, 13
Watchdog timer	13

Overview

1

The AQR 4 Phase Modulator is designed to set phase and amplitude of the 3 channels of the SE451. Control of all internal parameters and communication to the spectrometer is done via the HPCU (High Power Control Unit). Parameter changes can either be initiated by the HPCU keyboard or by spectrometer computer. The 4 Phase Modulator is linked by an **SBS-Bus** Interface to the HPCU. This enables future expansion to a second 4 Phase Modulator controlled by the same HPCU. The standard configuration is equipped for 2 channels (P/N H5649), but optionally it can be fitted for all three channels (P/N H5485).

Figure 1.1. 4 Phase Modulator Board



Hardware

2

General

2.1

The Hardware of the 4 Phase Modulator can be divided into two functional sections; the digital section, to communicate with the host system and control of all the internal parameters; and the analog section consisting of the output stages for the amplitude- and phase control.

Digitalsection

2.2

CPU

2.2.1

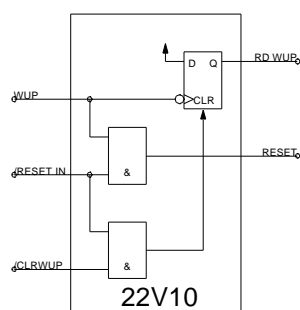
The CPU is the microcontroller 80C535 from Siemens (U67). For memory a OTProm 27265 (32 kByte) or 27512 (64 kByte) (U62) is used to store the **boot and download firmware**; a Flash Eprom 28F256 (32 kByte) (U76) is used to store the **application specific firmware** and a RAM 62256 (32 kByte) (U70) to store parameters. The use of Flash Eproms enables downloading of new firmware even by the customer, without opening the unit. The microcontroller runs with a frequency of 12 MHz.

Reset and Wake Up signal

2.2.2

Generation of the reset signal is done inside the Pal 22V10 (U68) (see also Pal Listings).

Figure 2.1. Reset Logic



Both inputs /RESET IN and WUP (Wake Up) can generate a reset signal for the microcontroller. After a reset, the reset source can be read by the output RD-WUP

(read Wake Up). After reset by WUP the D-Flip-Flop inside the pal is set and the output RD-WUP is high. The Flip-Flop can be cleared by a signal from the microcontroller (CLRWUP) or by a reset activated by the reset controller TL7705 (U74). This enables a High at RD-WUP only after a Wake Up (Wake Up is a signal from **SBS-BUS**, used to reactivate the unit after Sleep Mode).

Decoder

2.2.3

The remainder of the pal logic is used to decode the Memory section. The memory map is dependant on the signal PGMODE (Program Mode) at Pin P1.4 of 80C535.

Table 2.1. Memory Decoder

PGMode	Eprom	Flash Eprom	Ram
0	not mapped	Code 0x0000 - 0xFFFF	Data 0x0000 - 0x7FFFF
1	Code 0x0000 - 0x7FFF	Data 0x0000 - 0x7FFF	not mapped

DAC Controlling

2.2.4

Control of the 6 DAC's is not performed by address databus, but with 2 of the microcontroller ports. The data lines for the DAC's are driven by Port 4 and the control lines by Port 5. To select the DAC's, 3 port lines are decoded by a 3 to 8 multiplexer 74LS138 (U66). The lines WR (Write), LE (Latch Enable), A0, A1, A2 (Address 0, 1, 2) are driven by the remaining 5 port pins of Port5. The DAC input CLR (Clear) is driven directly from the reset signal to clear the Dac after a hardware reset (0x8000 = 0 volts).

I²C E²Prom

2.2.5

A serial E²Prom X24C16 (U75) with I²C bus-structure is used to store all BBIS (**Bruker Board Information System**) data and important system parameters (Setup, last configuration, etc.).

SBS-Bus Interface

2.2.6

For communication with a host system, an SBS-Bus Interface is implemented. The interface is galvanically isolated. The supply for the interface drivers can be either a 9 volt supply voltage from the SBS Bus for a galvanic isolated interface (J5: connect pin 2 with pin 3, J6: no connection), or the boards internal supply (J5: connect pin 1 with pin 2, J6: pin1 to pin 2 connected) for a non isolated interface (mostly used during test or when interfaced to a PC using an RS232 to RS485 converter). The SBS Bus address can be selected by Jumper J4 (jumper set = address 1, jumper not set = address 0 = default setting). To use only one 4 Phase Modulator in a system, use address 0. To terminate the interface the jumpers J1, J2, J3 must be set in the last unit in the SBS Bus net.

Analogsection**2.3**

DA-Converter**2.3.1**

If totally populated, there are 6 Quad 12Bit DAC's DAC 4815AP (U1, U2, U3, U31, U32, U33) from Burr Brown. Every DAC output is driven by an OP AD 846 to a specific level. Two Dac outputs are used to generate the Receiver Phase outputs (SIN and COS).

Analog switch**2.3.2**

For each of the 3 channels of the 4 Phase Modulator there are the following outputs:

- Amplitude +Y (-150mV to -500mV) and Amplitude -Y(150mV to 500mV) - Phase +X (0V) and Phase -X (-150mV to +150mV) and - Amplitude +X (150mV to 500mV) and Amplitude -X(-150mV to -500mV) - Phase +Y (-150V to +150mV) and Phase -Y (-150mV to +150mV)

Phase +X is 0 volts in every channel (referencephase). 4 outputs of each channel build one functional block. They are switched with analog switches (HI201HS) to a common output, in that way, that amplitude and phase from the selected quadrant are switched to the outputs (for example: Amplitude +Y and Phase +Y or Amplitude -X and Phase -X). The analog switches are controlled by the spectrometer. Decoding of the pulses is done by two Pal's 22V10 (U58 and U59) (see pal listing). Control of the analog switches can also be done by the microcontroller. Therefore the pin TESTEN (Test enable) must be driven low by the microcontroller, which is now able to select the analog switches using the pins TEST1 and TEST2. This is only necessary for test purposes.

General

3.1

The software of the 4 Phase Modulator consists of two independent modules; the boot firmware and the application firmware.

3.1. Boot firmware

3.2

The boot firmware controls the reset sequence and downloading of new firmware releases. After initialization, it checks if there is a valid application firmware stored on the Flash Eprom. If all tests are good, it switches to the application program by driving pin PGMODE P1.4 to low. This causes the memory decoder now to use the Flash Eprom as the code memory and the Ram as a data memory. The application program can now run. While the boot program is running, the memory decoder maps the OTProm as code memory and the Flash Eprom as Data memory (only data memory can be written by microcontroller). As Ram, only the internal memory of the microcontroller is used.

3.2. Application firmware

3.3

All application specific functions for the 4 Phase Modulator are controlled by the application program. After a software reset, which is performed after switching from the boot program, the program tests if the reset was initiated by a Wake Up signal or by the reset controller by reading the output RDWUP from Pal 22V10 (U68). Depending on the reset source the hardware will be initiated. After a hardware reset, all DAC's are loaded with the last value, stored in I²C E²Prom. If no reasonable value is stored, maybe after first power on or a defective E²Prom, all DAC outputs are cleared to 0 volts. After reset by Wake Up, the DAC outputs are not modified, they hold on the value loaded before sleep modus. After initialization of the whole hardware the program goes to the main loop. The main loop handles the following program parts:

- Command interpreter for all SBS Bus commands.
- Update of E²Prom (every new output value will be stored on E²Prom after a timeout of 10 seconds).
- Dac output setting.
- Watchdog timer refresh.
- Test routines if enabled.

Connector Pinout

4

Control Out

4.1

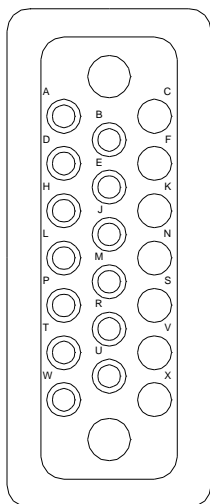


Table 4.1. Control Out Burndy 20 Pin RM

Pin No.	new Name	old Name	Connected to
A	-	-	-
B	-	-	-
C	-	-	-
D	-	-	-
E	-	-	-
F	-	-	-
H	PH(x)CH1	FX current x	TP 9
J	PH(x)CH2	FH current x	TP 7
K	-	-	-
L	PH(y)CH1	FX current y	TP 16
M	PH(y)CH2	FH current y	TP 15
N	-	-	-
P	SIN	SIN	TP 10
R	-	-	-
S	-	-	-
T	COS	COS	TP 8
U	PH(x)CH3	FY current x	TP 6
V	-	-	-
W	PH(y)CH3	FY current y	TP 14
X	-	-	-

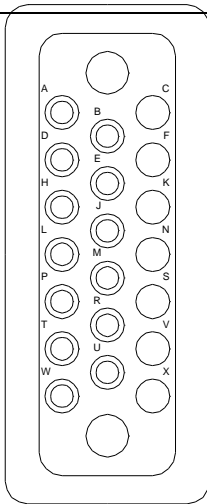


Table 4.2. Control In Burndy 20 Pin RM

Pin No.	new Name	old Name	connected to
A	PH1CH1	PHI90FX	TP 25
B	PH2CH1	PHI180FX	TP 26
C	-	-	-
D	-	-	-
E	-	-	-
F	-	-	-
H	PH1CH2	PHI90FH	TP 27
J	PH2CH2	PHI180FH	TP 28
K	-	-	-
L	-	-	-
M	-	-	-
N	-	-	-
P	PH1CH3	PHI90FY	TP 23
R	PH2CH3	PHI180FY	TP 24
S	-	-	-
T	-	-	-
U	-	-	-
V	-	-	-
W	-	-	-
X	-	-	-

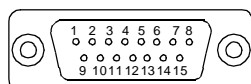


Table 4.3. SBS Slave 15 Pin Mini-D Male

Pin No.	Pin Name
1	Shield
2	RxD+
3	WUP
4	TxD+
5	-
6	GND
7	GND
8	GND
9	RxD-
10	-
11	TxD-
12	-
13	VRS +12V
14	VRS +12V
15	VRS +12V

PAL Listings

A

*IDENTIFICATION PAL U58 and U59

Company: Bruker Analytische Meßtechnik
 D-7512 Rheinstetten 4/Karlsruhe
 Silberstreifen
 Designer: Bernd Jenissen Abt. I MSL
 Date: 07.01.93
 Pal:
 Part name: PM00AA58-KM + PM00AA59-KM
 Part number: H5430
 Revision: AA

Assembly:
 Part name: 4 PHASE MODULATOR
 Part number: H5263
 Revision: B
 Pal location: IC 58 + IC 59
 File name: MODMUVBN.DCB

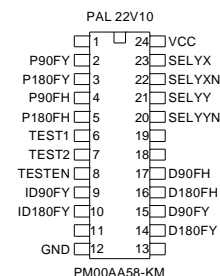
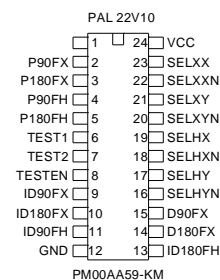
*Comment
 Inputmultiplexer for 4 Phase-Modulator

*X-NAMES

P90FX , ! Inputsignal Channel 1 90 degree
 P180FX , ! Inputsignal Channel 1 180 degree
 P90FH , ! Inputsignal Channel 2 90 degree
 P180FH , ! Inputsignal Channel 2 180 degree
 P90FY , ! Inputsignal Channel 3 90 degree
 P180FY , ! Inputsignal Channel 3 180 degree
 ID90FX , ! Inputsignal Channel 1 90 degree, delayed
 ID180FX , ! Inputsignal Channel 1 180 degree, delayed
 ID90FH , ! Inputsignal Channel 2 90 degree, delayed
 ID180FH , ! Inputsignal Channel 2 180 degree, delayed
 ID90FY , ! Inputsignal Channel 2 90 degree, delayed
 ID180FY , ! Inputsignal Channel 2 180 degree, delayed
 TEST1 , ! Testsignal Channel 1+2 90 degree
 TEST2 , ! Testsignal Channel 1+2 180 degree
 TESTEN ; ! Test enabled from CPU

*Y-NAMES

D90FX , ! Output. f. delayed Inputsignal Channel 1 90 degree
 D180FX , ! Output. f. delayed Inputsignal Channel 1 180 degree
 D90FH , ! Output. f. delayed Inputsignal Channel 2 90 degree
 D180FH , ! Output. f. delayed Inputsignal Channel 2 180 degree
 D90FY , ! Output. f. delayed Inputsignal Channel 2 90 degree
 D180FY , ! Output. f. delayed Inputsignal Channel 2 180 degree
 SELXX , ! Output Channel 1 X
 SELXXN , ! Output Channel 1 X -
 SELXY , ! Output Channel 1 Y
 SELXYN , ! Output Channel 1 Y -
 SELHX , ! Output Channel 2 X
 SELHXN , ! Output Channel 2 X -
 SELHY , ! Output Channel 2 Y
 SELHYN , ! Output Channel 2 Y -
 SELYX , ! Output Channel 3 X
 SELYXN , ! Output Channel 3 X -
 SELYY , ! Output Channel 3 Y
 SELYYN ; ! Output Channel 3 Y -



```

*FUNCTION-TABLE

! delay Inputsignals

$P90FX:D90FX ;
  0 : 0 ;
  REST : 1 ;

$P180FX:D180FX ;
  0 : 0 ;
  REST : 1 ;

$P90FH:D90FH ;
  0 : 0 ;
  REST : 1 ;

$P180FH:D180FH ;
  0 : 0 ;
  REST : 1 ;

$P90FY:D90FY ;
  0 : 0 ;
  REST : 1 ;

$P180FY:D180FY ;
  0 : 0 ;
  REST : 1 ;

! Final Function

$TESTEN,TEST2,TEST1,P180FX,P90FX,ID180FX,ID90FX:SELXX,SELXXN,SELXY,SELXYN;
  0 , 0 , 0 , - , - , - , - : 0 , 1 , 1 , 1 ;
  0 , 0 , 1 , - , - , - , - : 1 , 1 , 0 , 1 ;
  0 , 1 , 0 , - , - , - , - : 1 , 0 , 1 , 1 ;
  0 , 1 , 1 , - , - , - , - : 1 , 1 , 1 , 0 ;
  1 , - , - , 0 , 0 , 0 , 0 : 0 , 1 , 1 , 1 ;
  1 , - , - , 0 , 1 , 0 , 1 : 1 , 1 , 0 , 1 ;
  1 , - , - , 1 , 0 , 1 , 0 : 1 , 0 , 1 , 1 ;
  1 , - , - , 1 , 1 , 1 , 1 : 1 , 1 , 1 , 0 ;
  REST : 1 , 1 , 1 , 1 ;

$TESTEN,TEST2,TEST1,P180FH,P90FH,ID180FH,ID90FH:SELHX,SELHXN,SELHY,SELHYN ;
  0 , 0 , 0 , - , - , - , - : 0 , 1 , 1 , 1 ;
  0 , 0 , 1 , - , - , - , - : 1 , 1 , 0 , 1 ;
  0 , 1 , 0 , - , - , - , - : 1 , 0 , 1 , 1 ;
  0 , 1 , 1 , - , - , - , - : 1 , 1 , 1 , 0 ;
  1 , - , - , 0 , 0 , 0 , 0 : 0 , 1 , 1 , 1 ;
  1 , - , - , 0 , 1 , 0 , 1 : 1 , 1 , 0 , 1 ;
  1 , - , - , 1 , 0 , 1 , 0 : 1 , 0 , 1 , 1 ;
  1 , - , - , 1 , 1 , 1 , 1 : 1 , 1 , 1 , 0 ;
  REST : 1 , 1 , 1 , 1 ;

$TESTEN,TEST2,TEST1,P180FY,P90FY,ID180FY,ID90FY:SELYX,SELYXN,SELYY,SELYYN ;
  0 , 0 , 0 , - , - , - , - : 0 , 1 , 1 , 1 ;
  0 , 0 , 1 , - , - , - , - : 1 , 1 , 0 , 1 ;
  0 , 1 , 0 , - , - , - , - : 1 , 0 , 1 , 1 ;
  0 , 1 , 1 , - , - , - , - : 1 , 1 , 1 , 0 ;
  1 , - , - , 0 , 0 , 0 , 0 : 0 , 1 , 1 , 1 ;
  1 , - , - , 0 , 1 , 0 , 1 : 1 , 1 , 0 , 1 ;
  1 , - , - , 1 , 0 , 1 , 0 : 1 , 0 , 1 , 1 ;
  1 , - , - , 1 , 1 , 1 , 1 : 1 , 1 , 1 , 0 ;
  REST : 1 , 1 , 1 , 1 ;

*RUN-CONTROL
LISTING = SYMBOLTABLE, NETTABLE ;
OPTIMIZE = P-TERMS ;

*END

```

```

*IDENTIFICATION
  LOG/iC Partitioner 3.4-08   92/11/30  11:18:45
@DEVICE = PM00AA59 ;

*PLD
  TYPE =  AMPAL22V10;

*PINS
  P90FX  =  2 ,
  P180FX =  3 ,
  P90FH  =  4 ,
  P180FH =  5 ,
  ID90FX =  9 ,
  ID180FX= 10 ,
  ID90FH = 11 ,
  ID180FH= 13 ,
  TEST1  =  6 ,
  TEST2  =  7 ,
  TESTEN =  8 ,
  D90FX  = 15 ,
  D180FX = 14 ,
  SELXX  = 23 ,
  SELXXN = 22 ,
  SELXY  = 21 ,
  SELXYN = 20 ,
  SELHX  = 19 ,
  SELHXN = 18 ,
  SELHY  = 17 ,
  SELHYN = 16 ;

@ENDDEVICE = PM00AA59 ;

@DEVICE = PM00AA58 ;

*PLD
  TYPE =  AMPAL22V10;

*PINS
  P90FH  =  4 ,
  P180FH =  5 ,
  P90FY  =  2 ,
  P180FY =  3 ,
  ID90FY =  9 ,
  ID180FY = 10 ,
  TEST1  =  6 ,
  TEST2  =  7 ,
  TESTEN =  8 ,
  D90FH  = 17 ,
  D180FH = 16 ,
  D90FY  = 15 ,
  D180FY = 14 ,
  SELYX  = 23 ,
  SELYXN = 22 ,
  SELYY  = 21 ,
  SELYYN = 20;

@ENDDEVICE = PM00AA58;

*RUN-CONTROL

  Progformat=Jedec;

  Listing=Equations,Pinout;

  TESTVECTOR = GENERATE;

*END

```

***IDENTIFICATION PAL U68**

Company: BRUKER ELEKTRONIK GmbH
 D-7512 Rheinstetten 4/Karlsruhe
 Akazienweg 2

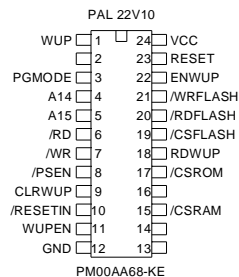
Designer: Uwe Döttling

Date: 02.06.92

PAL:
 Part name: PM00AA68-KE
 Part number: H5430
 Revision: AA

Assembly:
 Part name: 4 PHASE MODULATOR
 Part number: H5263
 Revision: B
 Pal location: IC 68

File name: 4PHDECA.DCB



***COMMENT**

THIS PAL WORKS AS AN ADDRESS DECODER AND MEMORY MAPPER.
 THE RESET LOGIC IS ALSO DONE BY THE PAL.

***X-NAMES**

WR ;LOW ACTIVE CPU WRITE SIGNAL
 RD ;LOW ACTIVE CPU READ SIGNAL
 PSEN ;LOW => CODE MEMORY, HIGH => DATA MEMORY
 A[15..14] ;HIGH ACTIVE CPU ADDRESSES
 PGMODE ;HIGH ACTIVE MODE BIT FOR MEMORY MAPPING AND FLASH WRITE
 WUPEN ;HIGH ACTIVE MODE BIT FOR WAKE UP ENABLE
 RESETIN ;LOW ACTIVE RESET INPUT FROM TL7705
 WUP ;LOW ACTIVE WAKE UP INPUT FROM 74LS123
 CLRWUP ;RESET D-FLIP FLOP SET BY WUP

***Y-NAMES**

CSRAM ;LOW ACTIVE CHIP SELECT FOR RAM
 CSROM ;LOW ACTIVE CHIP SELECT FOR BOOT EPROM
 CSFLASH ;LOW ACTIVE CHIP SELECT FOR FLASH EPROM
 RDFLASH ;LOW ACTIVE READ SIGNAL EITHER /RD OR /PSEN FOR FLASH EPROM
 WRFLASH ;LOW ACTIVE WRITE SIGNAL FOR FLASH EPROM
 ENWUP ;HIGH ACTIVE ENABLES WAKE UP FROM RS485
 RESET ;LOW ACTIVE RESET OUT TO 80535
 RDWUP ;READ D-FLIP FLOP ACTIVATED BY WUP
 TEMP ;TEMPORAR OUTPUT TO GENERATE RESET TERM FOR ASYNCHRON RESET
 ;OF ALL D-FLIP FLOPS

***FUNKTION-TABLE**

\$ WUPEN : ENWUP ;JUST AN INVERTER
 0 : 1 ;WAKE UP ENABLED
 1 : 0 ;WAKE UP DISABLED

\$ (A[15..14]),PGMODE,PSEN:CSROM,CSFLASH,CSRAM;CHIP SELECTS

0H..03H	,	1	,	-	:	0	,	0	,	1		;EPROM+FLASH IN DOWN MODE
0H..01H	,	0	,	-	:	1	,	0	,	0		;FLASH+RAM IN NORMAL MODE
2H..03H	,	0	,	-	:	1	,	0	,	1		;FLASH IN NORMAL MODE
REST					:	1	,	1	,	1		;ELSE NOTHING

\$ (A[15..14]),PGMODE,RD,WR,PSEN:RDFLASH,WRFLASH;

0H..03H	,	1	,	1	,	0	,	1	:	1	,	0		;FLASH WR IN DATA LOC.
0H..03H	,	1	,	0	,	1	,	1	:	0	,	1		;FLASH RD IN DATA LOC.
0H..03H	,	0	,	1	,	1	,	0	:	0	,	1		;FLASH RD IN CODE LOC.
REST					:	1	,	1						

```

$ WUP, RESETIN : RESET ;RESET OUTPUT FOR 80535
0 , 1 : 1 ;RESET SOURCE IS EITHER RESETIN OR WUPIN
REST : 0 ;

*BOOLEAN-EQUATIONS

TEMP = /RESETIN + /CLRWUP ;TEMPORARY TERM TO CLEAR D-FLIP FLOPS
RDWUP.RS = TEMP ;CLEAR ALL FLIP FLOPS ASYNCHRONOUS
RDWUP := VCC ;LOW -> HIGH AT CLOCK BRINGS RDWUP HIGH

*SPECIAL-FUNCTIONS

RDWUP.INV = NO ;OUTPUT RDWUP NOT INVERTED
RDWUP.REG = YES ;AND OUTPUT RDWUP IS USING REGISTERS

*RUN-CONTROL

LISTING = PLOT, EQUATIONS, PINOUT, SYMBOLTABLE;
OPTIMIZE = P-TERMS;
PROGFORMAT = JEDEC;
TESTVECTORS = GENERATE;

*PLD

TYPE = PAL22V10;
CHECKSUM = COMPUTE;

*PINS

WUP = 1,
PGMODE = 3,
A14 = 4,
A15 = 5,
RD = 6,
WR = 7,
PSEN = 8,
CLRWUP = 9,
RESETIN = 10,
WUPEN = 11,
TEMP = 14,
CSRAM = 15,
DACWR = 16,
CSROM = 17,
RDWUP = 18,
CSFLASH = 19,
RDFLASH = 20,
WRFLASH = 21,
ENWUP = 22,
RESET = 23;

*END

```


Schematics

B

On the following pages you will find the schematics in the following order:

AQR 4 Phase Modulator CPU

AQR 4 Phase Modulator SBS-Bus

AQR 4 Phase Modulator PH(x)CH1

AQR 4 Phase Modulator PH(y)CH1

AQR 4 Phase Modulator PH(x)CH2

AQR 4 Phase Modulator PH(y)CH2

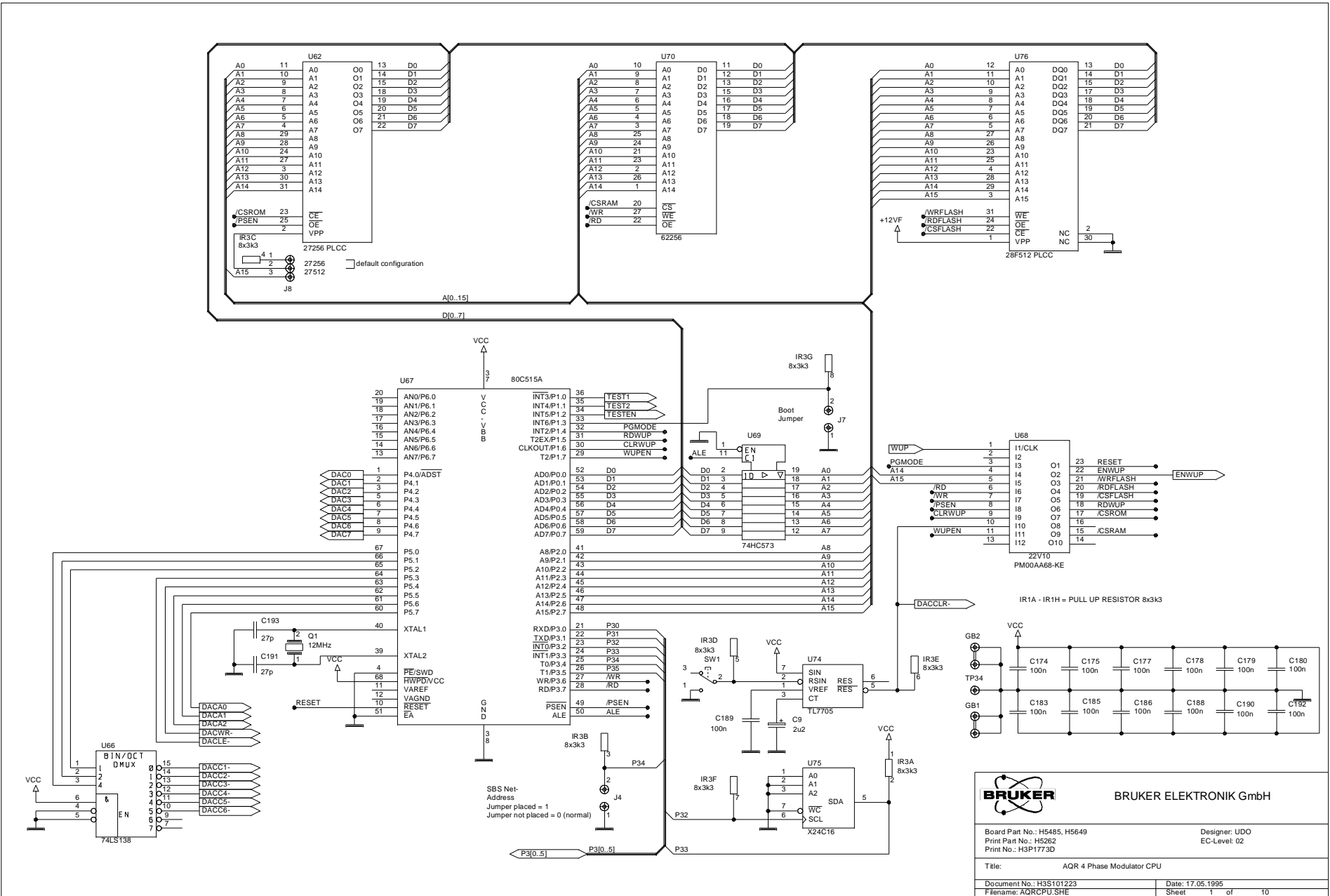
AQR 4 Phase Modulator PH(x)CH3

AQR 4 Phase Modulator PH(y)CH3

AQR 4 Phase Modulator Capacitors

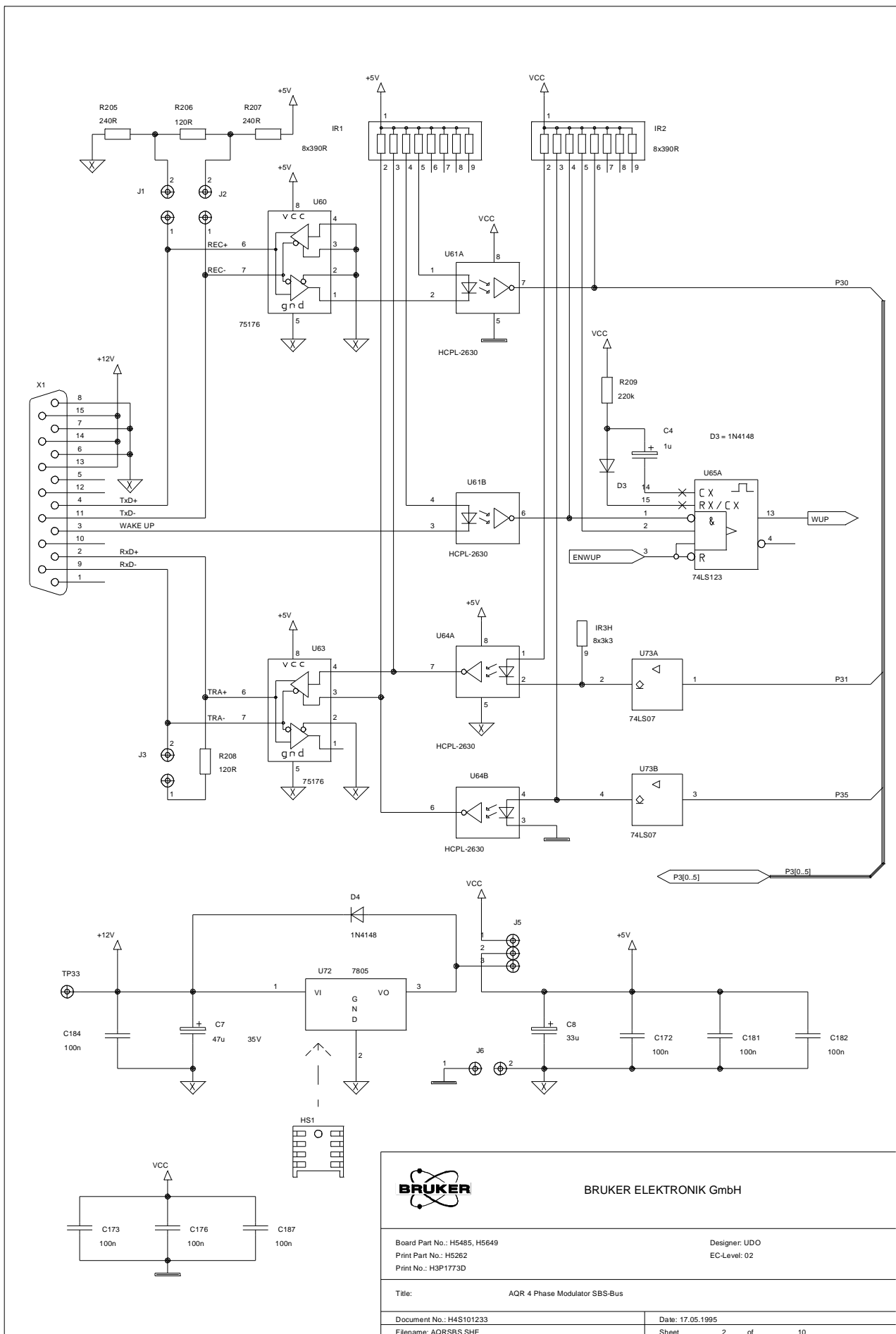
AQR 4 Phase Modulator Power

Figure B.1. AQR 4 Phase Modulator CPU



BRUKER		BRUKER ELEKTRONIK GmbH	
Board Part No.: H5485, H5649		Designer: UDO	
Print Part No.: H5262		EC-Level: 02	
Print No.: H3P1773D			
Title: AQR 4 Phase Modulator CPU			
Document No.: H3S101223		Date: 17.05.1995	
Filename: AQRCPUSHE		Sheet 1 of 10	

Figure B.2. AQR 4 Phase Modulator SBS-Bus



BRUKER ELEKTRONIK GmbH

Board Part No.: H5485, H5649
 Print Part No.: H5262
 Print No.: H3P1773D

Designer: UDO
 EC-Level: 02

Title: AQR 4 Phase Modulator SBS-Bus

Document No.: H4S101233

Date: 17.05.1995

Filename: AQRSBS.SHE

Sheet 2 of 10

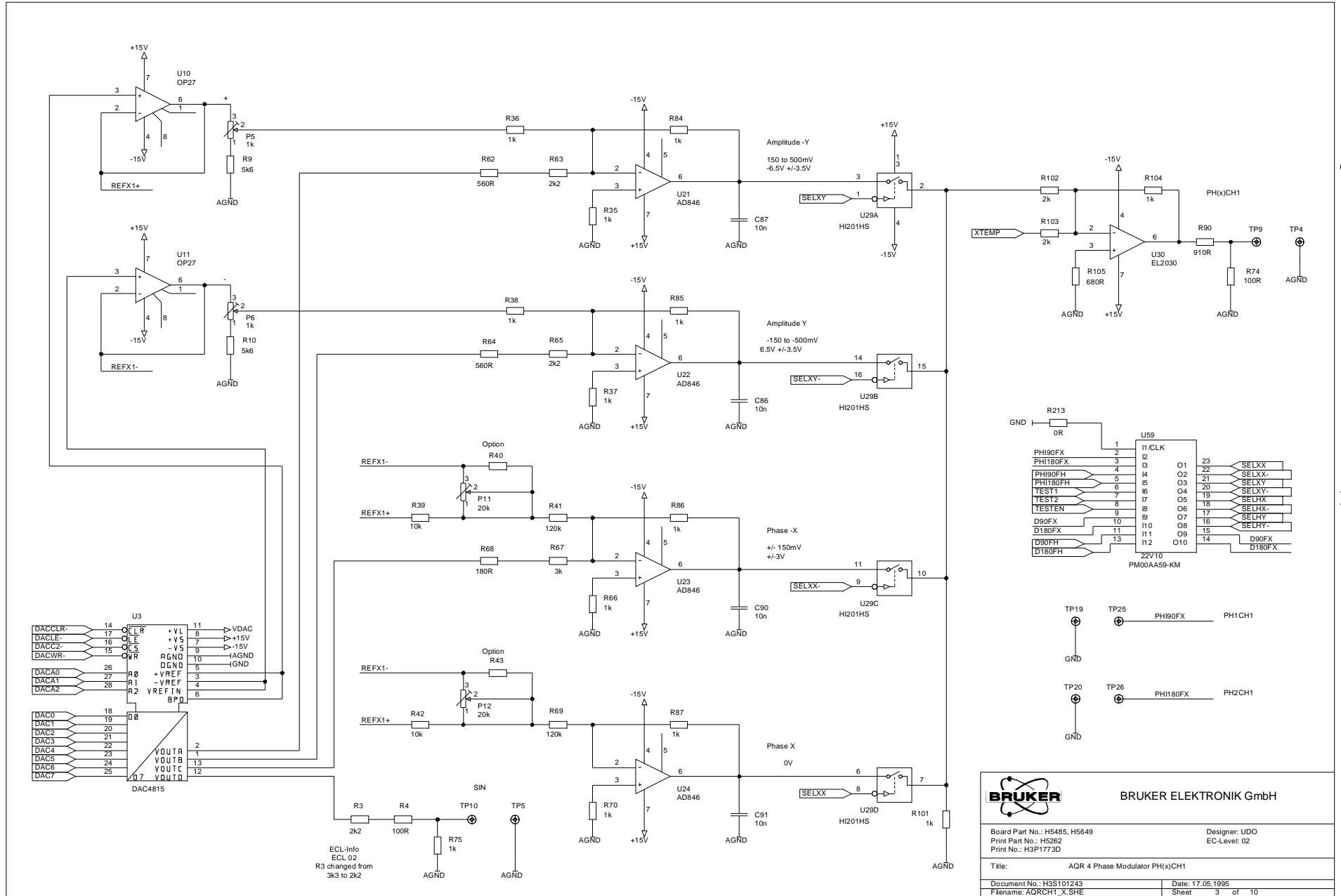


Figure B.3. AQR 4 Phase Modulator PH(x)CH1

BRUKER ELEKTRONIK GmbH	
Board Part No.: H5485, H5649 Print Part No.: H5262 Print No.: H3P1773D	Designer: UDO EC-Level: 02
Title: AQR 4 Phase Modulator PH(x)CH1	
Document No.: H35101243	Date: 17.05.1995
Filename: AQRCH1_X.SHE	Sheet 3 of 10

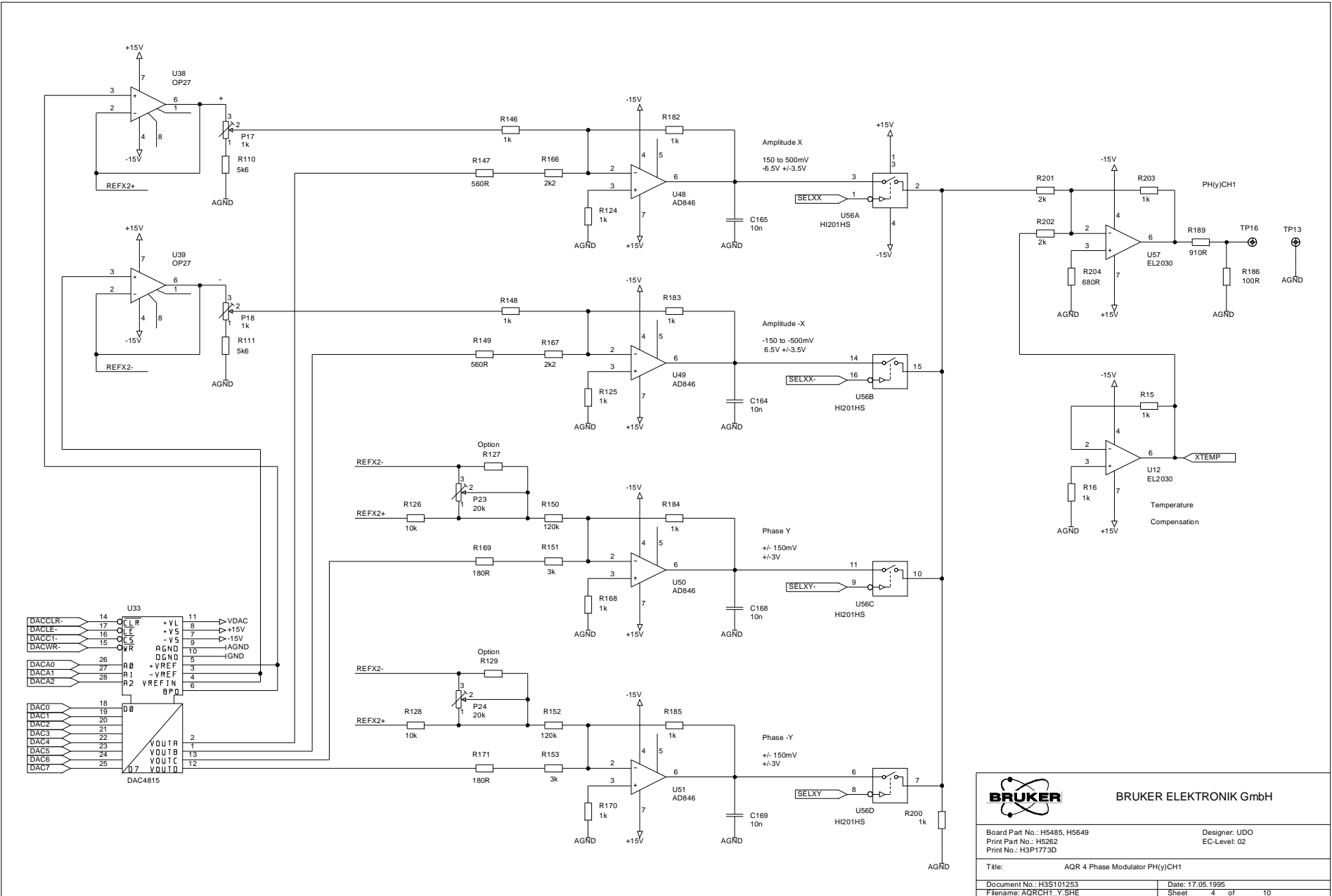


Figure B.4. AQR 4 Phase Modulator PH(y)CH1

BRUKER		BRUKER ELEKTRONIK GmbH	
Board Part No.: H5485, H5649		Designer: UDO	
Print Part No.: H5262		EC-Level: 02	
Print No.: H3P1773D			
Title: AQR 4 Phase Modulator PH(y)CH1			
Document No.: H3S101253	Date: 17.05.1995		
Filename: AQRCH1_Y.SHE	Sheet: 4 of 10		

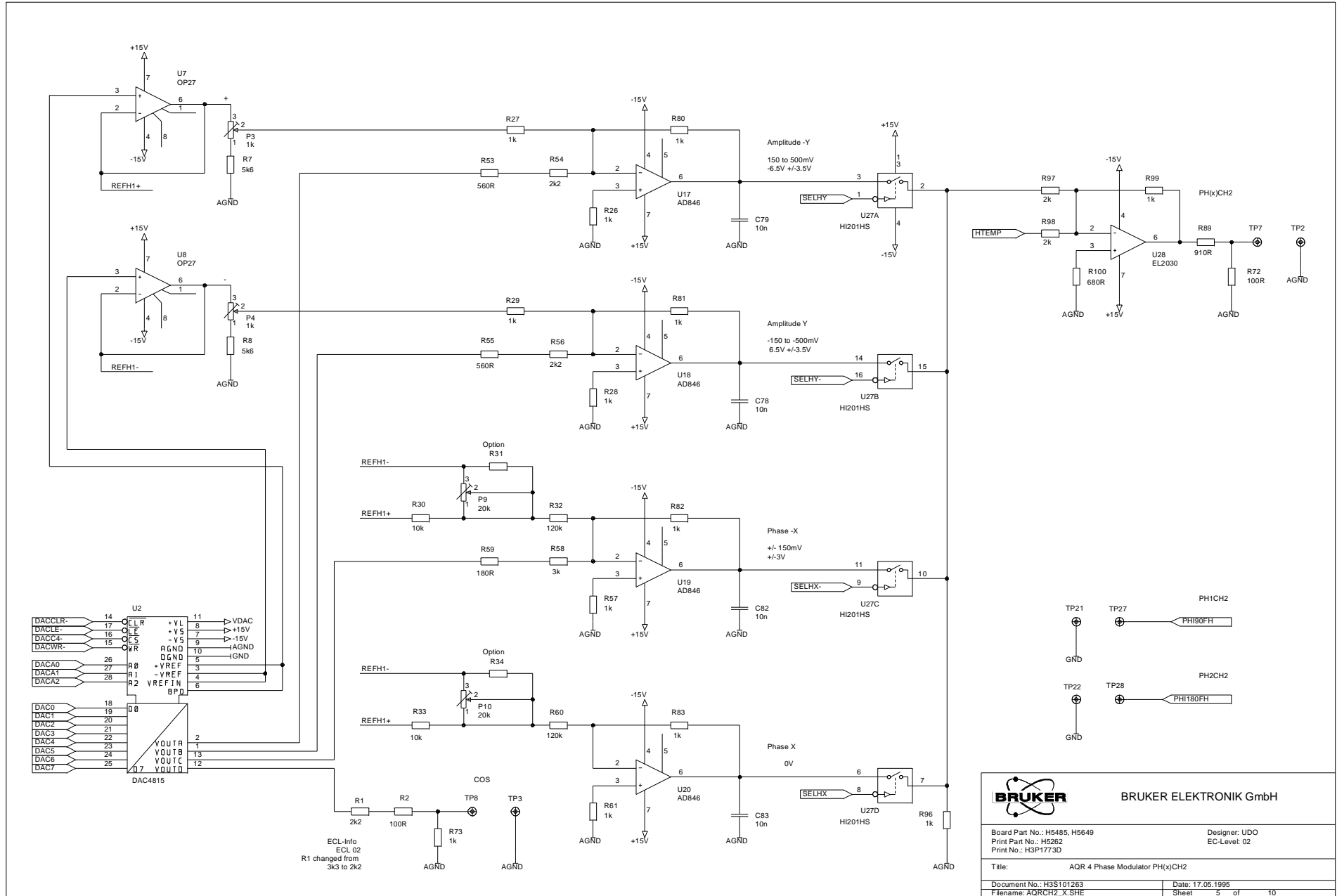


Figure B.5. AQR 4 Phase Modulator PH(x)CH2

BRUKER		BRUKER ELEKTRONIK GmbH	
Board Part No.: H5485, H5649		Designer: UDO	
Print Part No.: H5262		EC-Level: 02	
Print No.: H3P1773D			
Title: AQR 4 Phase Modulator PH(x)CH2			
Document No.: H3S101263		Date: 17.05.1995	
Filename: AQRCH2_X.SHE		Sheet 5 of 10	

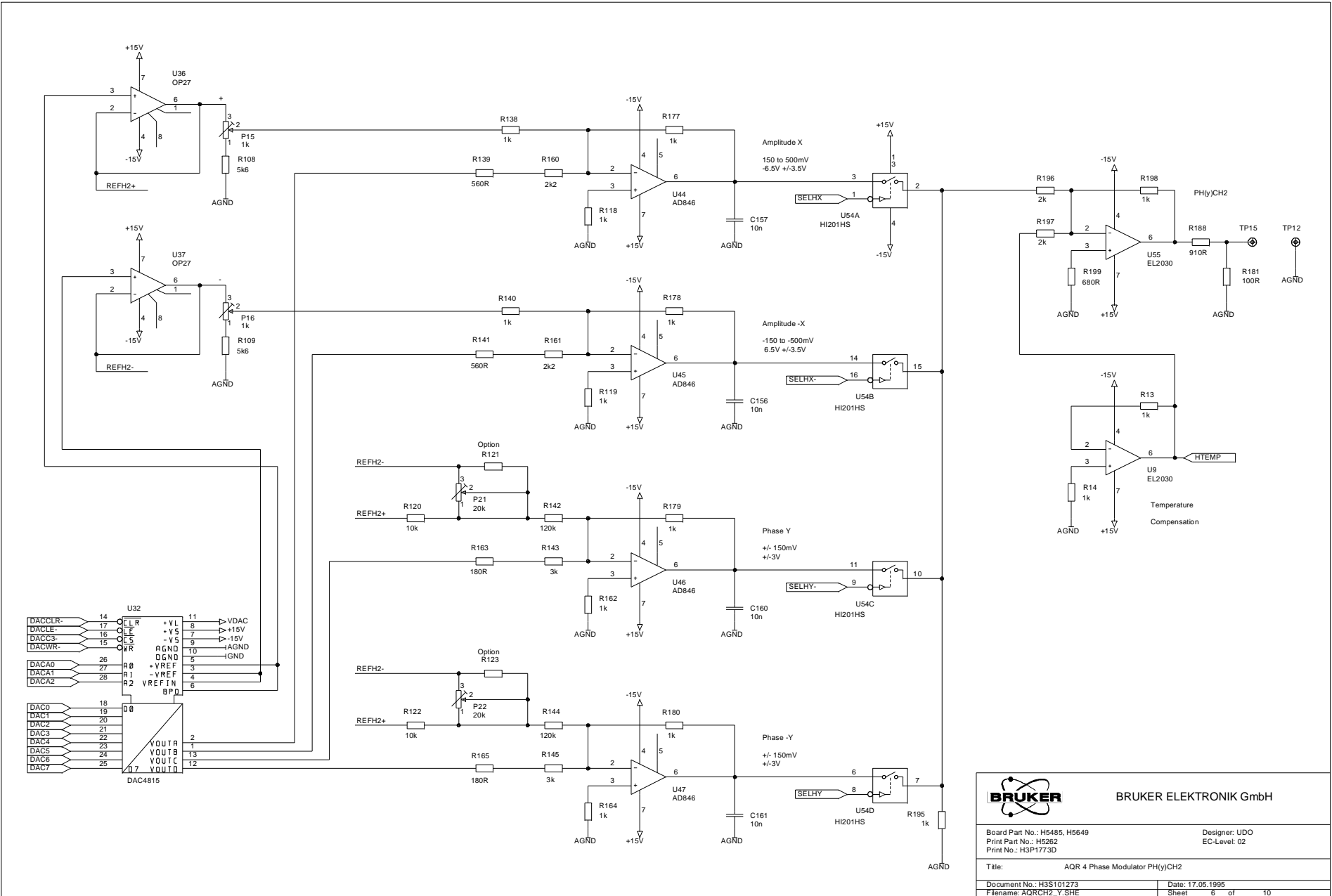
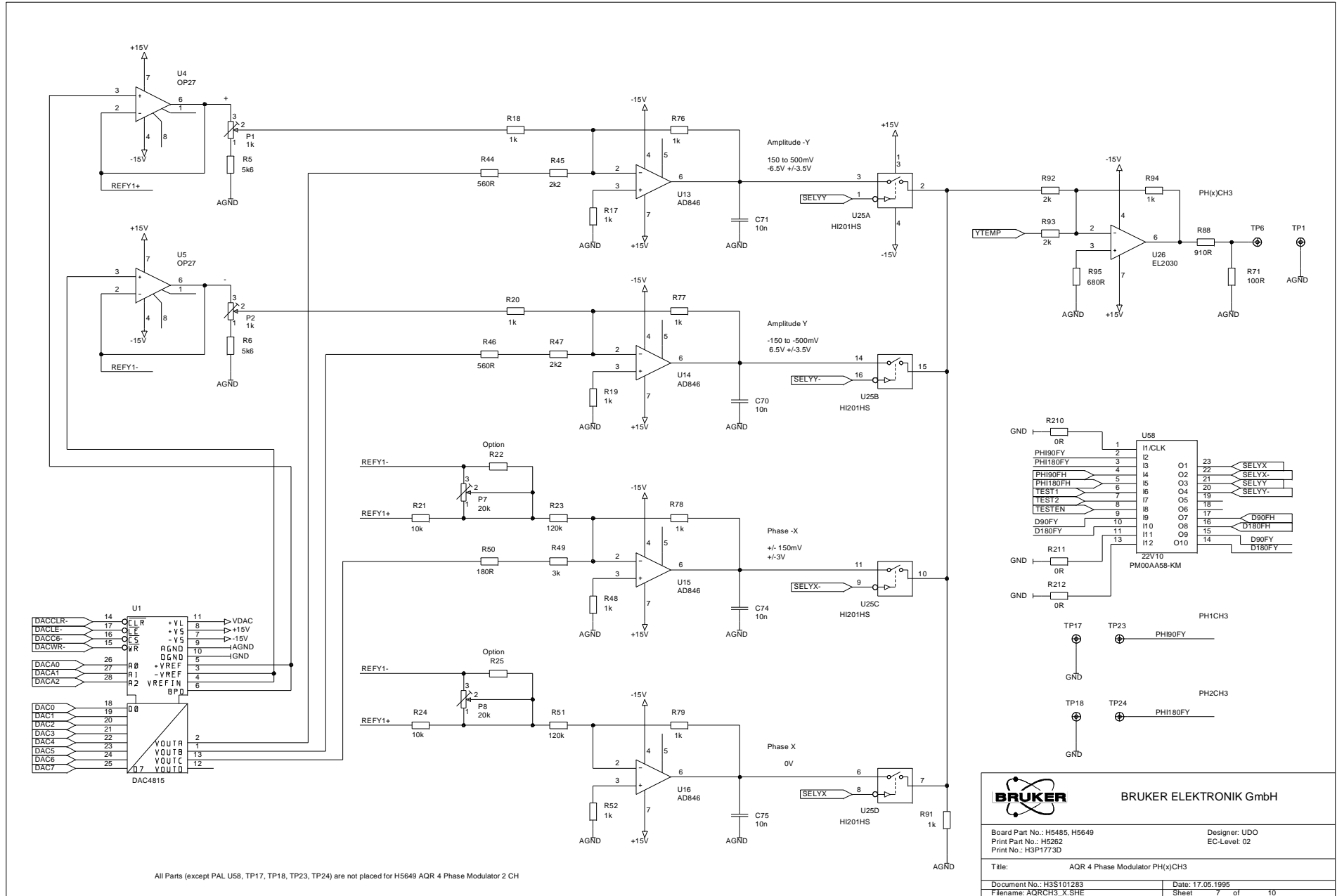


Figure B.6. AQR 4 Phase Modulator PH(y)CH2

BRUKER		BRUKER ELEKTRONIK GmbH	
Board Part No.: H5485, H5649		Designer: UDO	
Print Part No.: H5262		EC-Level: 02	
Print No.: H3P1773D			
Title: AQR 4 Phase Modulator PH(y)CH2			
Document No.: H3S101273		Date: 17.05.1995	
Filename: AQRCH2_Y.SHE		Sheet 6 of 10	



All Parts (except PAL U58, TP17, TP18, TP23, TP24) are not placed for H5649 AQR 4 Phase Modulator 2 CH

Figure B.7. AQR 4 Phase Modulator PH(x)CH3

BRUKER		BRUKER ELEKTRONIK GmbH	
Board Part No.: H5485, H5649		Designer: UDO	
Print Part No.: H5262		EC-Level: 02	
Print No.: H3P1773D			
Title: AQR 4 Phase Modulator PH(x)CH3			
Document No.: H3S101283	Date: 17.05.1995		
Filename: AQRCH3_X.SHE	Sheet 7 of 10		

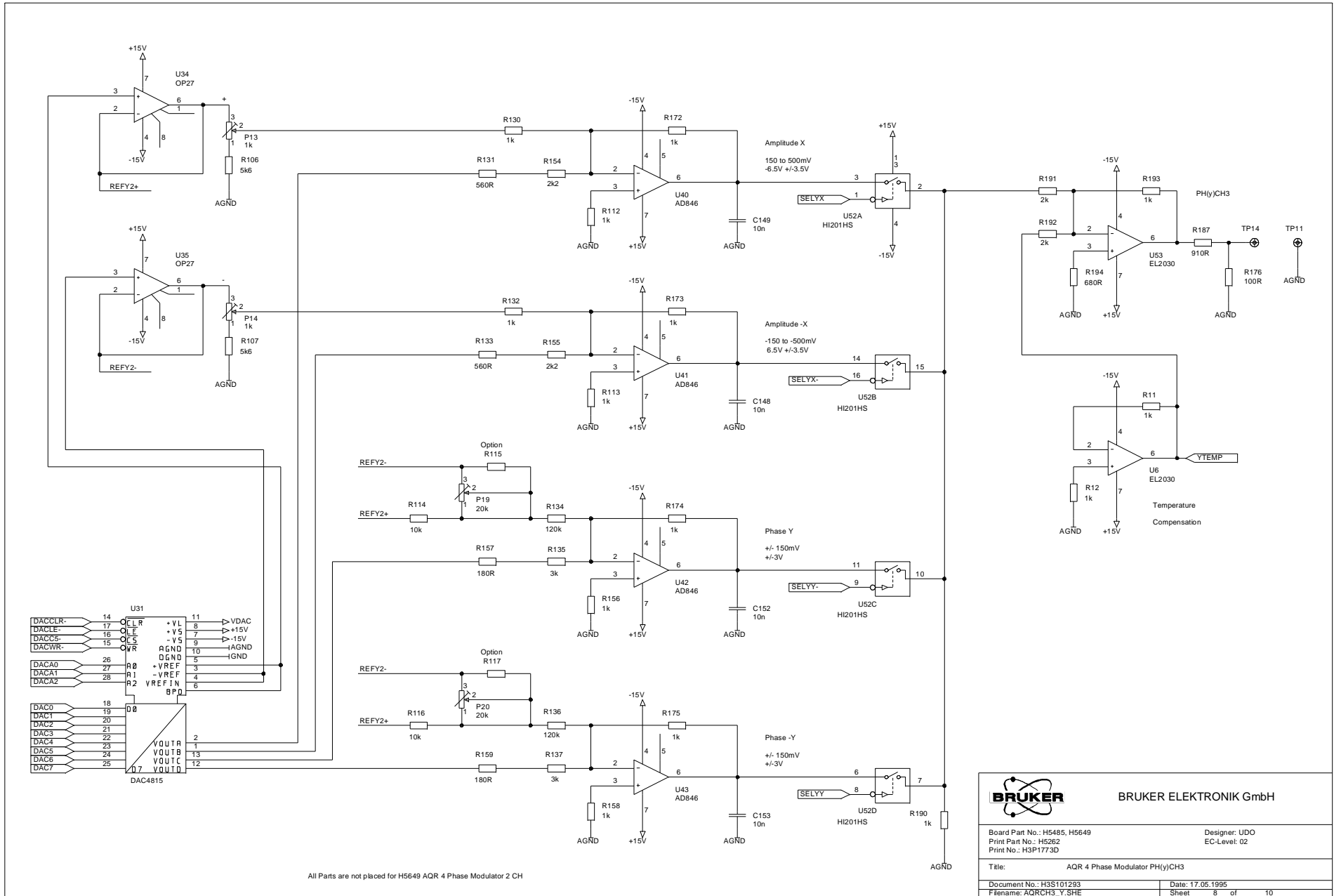
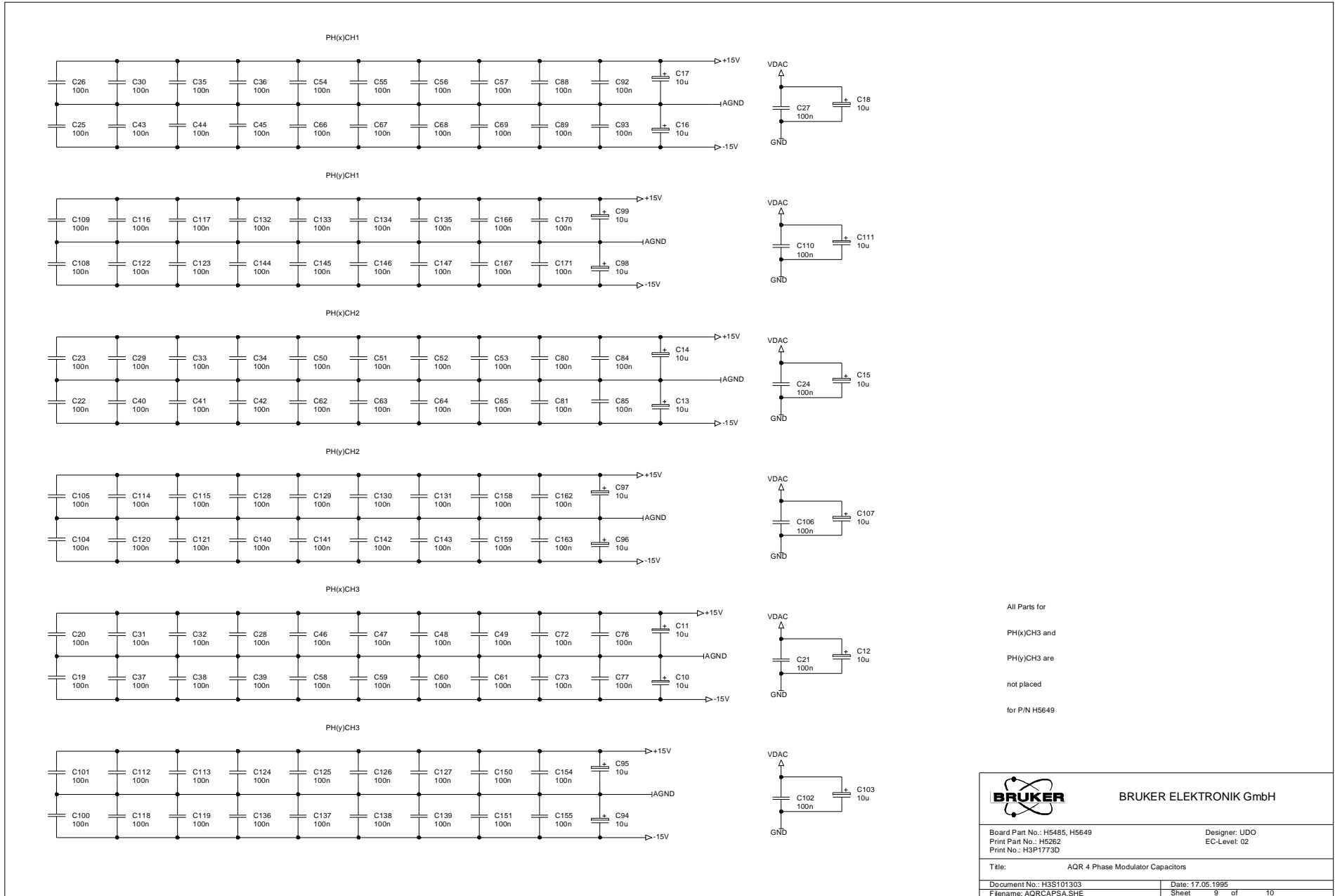



Figure B.8. AQR 4 Phase Modulator PH(y)CH3

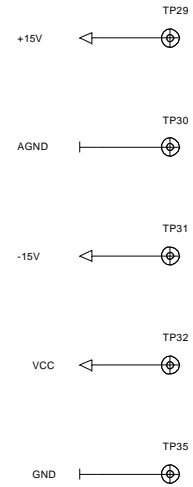
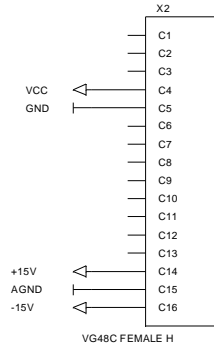
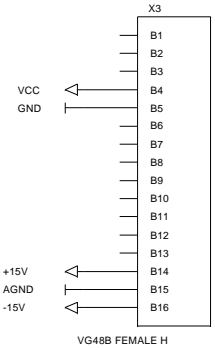
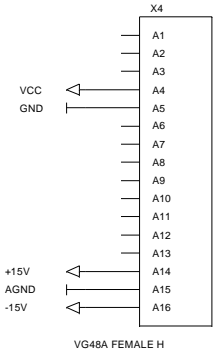
BRUKER		BRUKER ELEKTRONIK GmbH	
Board Part No.: H5485, H5649		Designer: UDO	
Print Part No.: H5262		EC-Level: 02	
Print No.: H3P1773D			
Title: AQR 4 Phase Modulator PH(y)CH3			
Document No.: H3S101293	Date: 17.05.1995		
Filename: AQRCH3_Y.SHE	Sheet: 8 of 10		

Figure B.9. AQR 4 Phase Modulator Capacitors

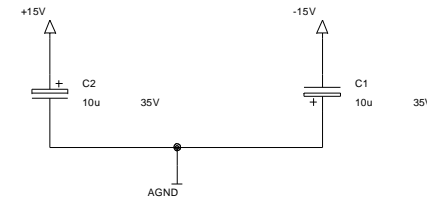
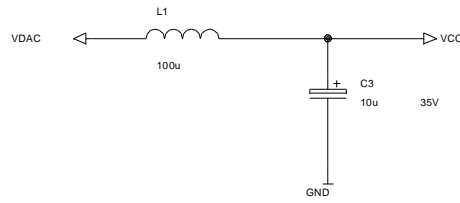
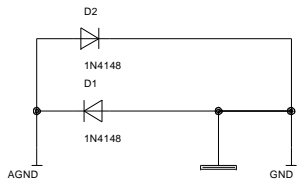


All Parts for
PH(x)CH3 and
PH(y)CH3 are
not placed
for P/N H5649

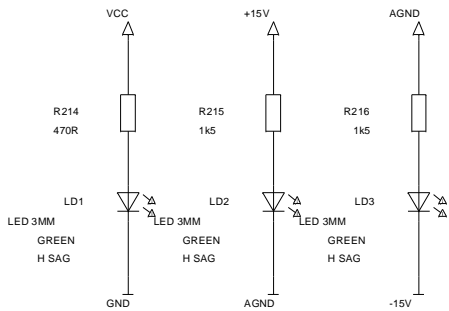
		BRUKER ELEKTRONIK GmbH	
Board Part No.: H5485, H5649		Designer: UDO	
Print Part No.: H5262		EC-Level: 02	
Print No.: H3P1773D			
Title: AQR 4 Phase Modulator Capacitors			
Document No.: H3S101303		Date: 17.05.1995	
Filename: AQRCAPSA.SHE		Sheet 9 of 10	



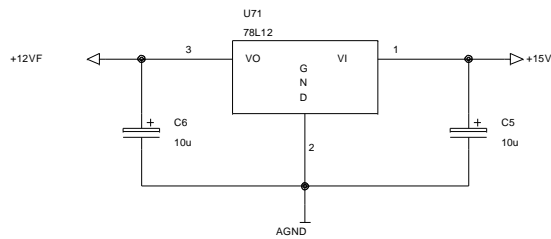
0 OHM Resistor placed instead of D1 and D2.



Power Supply LED's



12V for Flash Eprom



		BRUKER ELEKTRONIK GmbH	
Board Part No.: H5485, H5649		Designer: UDO	
Print Part No.: H5262		EC-Level:02	
Print No.: H3P1773D			
Title: AQR 4 Phase Modulator Power			
Document No.: H4S101313	Date: 17.05.1995		
Filename: AQRPOWER.SHE	Sheet	10	of 10

Figure B.10. AQR 4 Phase Modulator Power

Figures

1 Overview	7
Figure 1.1. 4 Phase Modulator Board	7
2 Hardware	9
Figure 2.1. Reset Logic	9
3 Software	13
4 Connector Pinout	15
A PAL Listings	19
B Schematics	25
Figure B.1. AQR 4 Phase Modulator CPU	26
Figure B.2. AQR 4 Phase Modulator SBS-Bus	27
Figure B.3. AQR 4 Phase Modulator PH(x)CH1	28
Figure B.4. AQR 4 Phase Modulator PH(y)CH1	29
Figure B.5. AQR 4 Phase Modulator PH(x)CH2	30
Figure B.6. AQR 4 Phase Modulator PH(y)CH2	31
Figure B.7. AQR 4 Phase Modulator PH(x)CH3	32
Figure B.8. AQR 4 Phase Modulator PH(y)CH3	33
Figure B.9. AQR 4 Phase Modulator Capacitors	34
Figure B.10. AQR 4 Phase Modulator Power	35

Tables

1	Overview	7
2	Hardware	9
Table 2.1.	Memory Decoder	10
3	Software	13
4	Connector Pinout	15
Table 4.1.	Control Out Burndy 20 Pin RM	15
Table 4.2.	Control In Burndy 20 Pin RM	16
Table 4.3.	SBS Slave 15 Pin Mini-D Male	17
A	PAL Listings	19
B	Schematics	25

