TECHNICAL DESCRIPTION FOR MP16 224 MHz VERSION

Part Number
H/2137/0131

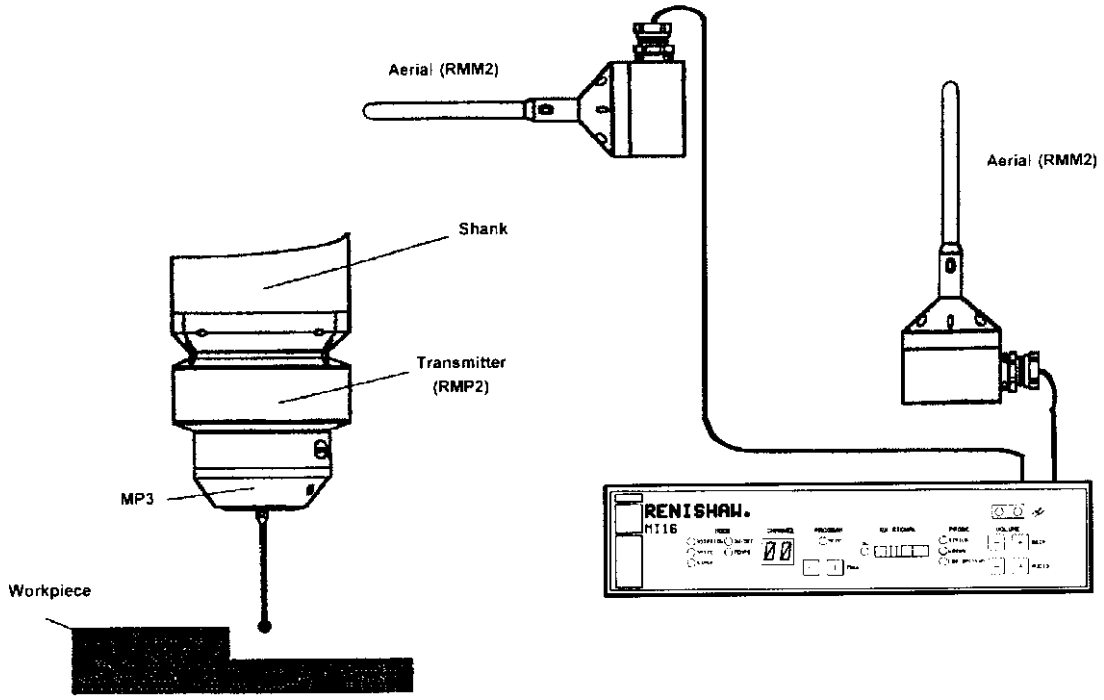
RENISHAW

FCC codes:
KQG RMP2-224
KQG MI16-224

ref mp16_224.doc

I. GENERAL DESCRIPTION

The radio probe MP16 made by RENISHAW is a non line-of-sight probing system designed to equip numerical controlled machine tools with in cycle measuring equipment.The installation comprises a probe (RMP2), two antennas (RMM2) and an interface (MI16).



II. RADIO PROBE DESCRIPTION

A. ANTENNA (RMM2)

The antennas are ¼ wavelength tuned and earth plane units with about 0.5 MHz bandwidth and a good VSWR of 1.2. The base is insulated and the grounding is made by capacitance to the machine body. A common problem has been seen of sympathetic radiators in machines, which lead to signal nulls. Sympathetic radiators are parts of machines which are also ¼ wavelength long or thereabouts; these receive and re-radiate the RF signal which can cause field cancellation and loss of signal.The use of two antennas and corresponding circuitry will correct this problem.

B. PROBE (RMP2)

1. GENERAL DESCRIPTION

The probe is assembled as a series of 3 PCB's, one with a RF transmitter module. The other boards contain the reference clock, the tracking probe interface, the set-up module, the switch and the power supply.

The method of operation is as follows. Two frequencies are derived from a 4 MHz crystal oscillator at nominally 500 and 1000 Hz, the 500 Hz is transmitted as a time reference to the modulation on the 1000 Hz. In the receiver the 500 Hz is used to synchronise a clock and regenerate a 1000 Hz for demodulation of the signal. On a probe change of state the time since the last 1000 Hz pulse is latched as an 8 bit word giving a resolution of 256. A start bit, a parity bit and a stop bit are added, and the information is sent as phase modulation on each cycle of the 1000 Hz carrier over the next 11 ms to the receiver. This decodes the time interval and adds it to the transmission frame time to give a precise delay from probe change of state to interface output change with an accuracy of around 4µs. The probe status (trigger or reseat) is carried by the fundamental modulation of the 1000 Hz carrier : in phase or antiphase. The low battery status information is sent as a 125 Hz signal.

An infrared link exists to set-up the probe channel and its mode. It operates in the following modes:

- Start by rotation and stop by rotation
- Start by rotation and stop by time out
- Start and stop by a shank switch
- Optical start and stop
- Optical start and stop by time out

2. POWER SUPPLY PCB

Six AA batteries supply a voltage of 9V to the input of a step-down switching regulator.

3. LOGIC AND INTERFACE PCB

This unit has a probe contact tracking interface and a high voltage generator, which together enhance the reseat performance of the probe.

A FPGA (Field Programmable Gate Arrays) contains the following logic:

- Probe contact debounce
- Clock divider
- 8 bits counter
- Parity generator
- Shift register
- Phase inverter generator.

The modulation frequencies are generated from a Walsh generator (stepped sine wave synthesis, using the shift register as ring counters). The 1000 Hz is phase modulated by inverting the output of the ring counter. In the same way a 125 Hz sine wave is generated when the batteries are below 6.5 V. The sine waves are combined in a low pass filter and sent to the transmitter. A PIC (Programmable controller) is used to control the programming of the mode and the channel by the infrared link.

4. TRANSMITTER 224 MHz

The transmitter operates at a nominal 224 MHz, the precise frequency set by 40 synthesised channels, spaced at 25 KHz intervals. The first channel is set to 224,5 MHz and the last to 225,475 MHz.
The reference clock for the synthesiser (UMA 1017) is 8 MHz. The output of the internal phase comparator controls the frequency of a voltage-controlled oscillator (VCO) with a varicap diode.

C. INTERFACE (MI16)

1. DESCRIPTION

The interface comprises a double receiver allowing diversity reception. Each receiver uses a double conversion system with a common local oscillator. The logic selects the strongest signal automatically.
Three switched capacitor filters are used to separate the frequencies of the demodulated signal, a highpass for the 1000 Hz, and bandpass for the 500 Hz and 125 Hz.
The 500 Hz is used in a phase locked loop (PLL) frequency multiplier to generate a 250 KHz reference clock. The VCO voltage in the PLL is held during the reception of a word to reduce the residual FM, and hence the timing errors.

A FPGA (Field Programmable Gate Arrays) contains the following logic:

- Clock divider to generate a second 500 Hz frequency for the PLL phase comparator
- 1000 Hz decoder

- Down counter to generate the additional part of the delay
- Parity check
- Error detection
- Status bit generation

The IF detector has a signal strength output which is fed to a bar graph driver to give a visual indication of signal strength. An error output is created if the received RF is too low.
An amplitude comparator detects the 125 Hz presence and generates a low battery bit.

The front panel displays:

- The channel number
- The probe mode
- The status mode
- The received signal strength
- The low battery information

2. RECEIVER MODULE

- A circuit SA601 includes a low noise amplifier (LNA) and a mixer. The output of the LNA is mixed with a synthesised signal around 204 MHz to deliver an IF signal at 21.4 MHz.
- The synthesiser used is a UMA 1017. The first local oscillator delivers a frequency of 203,1MHz for the first channel and 204,075 MHz for the last.
- A second frequency change is made using a built in detector (MC3371 Motorola). The RF portion is tuned to 21.4 MHz with a standard 21.4 MHz crystal filter. This frequency is converted to 455 KHz by a local oscillator, and passes through a narrow band pass ceramic filter for the spacing channel.

3. Filters

The following switched capacitor filters are used: 500 and 125 Hz bandpass and 1000 Hz highpass. The centre frequencies and relative phase shifts are set by a 50 KHz oscillator which is tuned by a trim pot.

4. RX VCO

This generates the 250 KHz clock for the precision time delay. The circuit is a conventional PLL frequency multiplier with the addition of special sample and hold circuitry to reduce the phase jitter during decoding. This improves the delay variation from 25µS to 10 µS.

5. FPGA

Inside the FPGA the 250 KHz is divided to generate a 500 Hz signal for the VCO phase comparator and a 1000 Hz to latch the received 1000 Hz signal into a serial to parallel shift register. The shift register loads data continuously, and the word reception sequence is triggered by a change of state in the MSB, which is the probe status, the word is loaded into a down counter to create the additional delay. If the parity check detected is bad, the logic is inhibited, the probe output forced to an open state, and an error signal set.

6. FRONT PANEL

The front panel is equipped with:

- A channel display
- Two programmation buttons "+" and "-"
- Five LED's indicating the type of start and stop method.
- Two infrared LED's for an optical link to set-up the probe channel and its mode.
- An LED « MEMO » used during the set-up.
- A bargraph to display the RX signal strength.
- Three LED's for probe status, error detection and low battery information.
- Four switch buttons to adjust the volume of the loudspeaker. Two for the received audio signal and two for the probe status beep.

The two switch buttons "+" and "-" are used for programming:

- Push "+" or "-" to select a higher or lower channel (1 to 40)
- Push the two together to change the probe mode.

Five probe modes are selectable:

- « ROTATION-ON/OFF » Start and stop by rotation which is detected inside the probe by a centrifugal switch.
- « ROTATION-TEMPO » Start by rotation and stop after a 3 mn time out.
- « SHANK-ON/OFF » Start and stop by a shank switch.
- « OPTIC-ON/OFF » Start and stop by an optical signal.
- « OPTIC-TEMPO » Optical starts and stops after a 3 mn time out.

Dossier .... : DAT
Depot ..... : 000
Code edition : <GP_NOEDI>

EDITION DES NOMENCLATURES
<LABO >

Date : 05/03/99

KQGRMP2-224

NOMENCLATURE : A2056F1021 / BASE / 001

PRODUIT	: References	: A2056F1021 A2056/1021/01/A	Designation	: PACKING KIT MP14	NIV 1
NOMENCLATURE	: Code / version	: BASE / 001	Design/ type	: NOMENCLATURE DE BASE	/ T
Gammes associees	: de fabrication	:			
	previs. charges	:		! ---- STOCK PRODUIT ----	
Calcul delai	: Quantite fixe de fabrication	: 5.00 / Delai : 15 / Cadencement : 15		! physique :	-37.00 UN
DEFINITION	: pour	: 1 produit			

Ref princ.	Ref secondaire	Designation	Specif.	Rep/Plan	Matiere	Type	Unite	Quantite	P.R.M.P	art. remp.
ETIQ107*49	ETIQ107*49	LABEL 107*49 PAPER ADHES				PD	UN	1.000	0.200	
ETIQ107*79	ETIQ107*79	LABEL 107*79 PAPER ADHES				PD	UN	2.000	0.590	
M2015F7545	M2015/7545/MA	LID PACKAGING RMP				PD	UN	1.000	74.440	
M2015F7546	M2015/7546/MA	BOX PACKAGING RMP				PD	UN	1.000	27.280	

Prix de revient : 103.100 Nb de composants : 4 Nb d'article(s) option(s) : 0 PVB : 0.000 %K PVB : V 0.0

Dossier .... : DAT
Depot ..... : 000
Code edition : <GF_NOEDI>

EDITION DES NOMENCLATURES
<LABO >

Date : 05/03/99
Page : 1

KQG RMP2-224

NOMENCLATURE : A2137F0250 / BASE / 001

PRODUIT : References : A2137F0250 A2137/0250/01/A Designation : RMP2 224MHZ US NIV 3
NOMENCLATURE : Code / version : BASE / 001 Design/ type : NOMENCLATURE DE BASE / T
Gammes associees : de fabrication :
previs. charges :
Calcul delai : Quantite fixe de fabrication : 5.00 / Delai : 15 / Cadencement : 15
DEFINITION : pour : 1 produit

! ---- STOCK PRODUIT ----
! physique : 2.00 UN

Ref princ.	Ref secondaire	Designation	Specif.	Rep/Plan	Matiere	Type	Unite	Quantite	P.R.M.P	Art. remp
A2056F1021	A2056/1021/01/A	PACKING KIT MP14	NIV 1			PC	UN	1.000	103.100	
A2137F0038	A2137/0038/01/A	RMP2 KIT	NIV 1			PC	UN	1.000	46.405	
A2137F0060	A2137/0060/01/A	FRONT RING ASSY	NIV 1			PC	UN	1.000	278.593	
A2137F0094	A2137/0094/01/A	EMITTER 224MHZ US	NIV 1			PC	UN	1.000	205.333	
A2137F0095	A2137/0095/01/A	CERAMIC SLEEVE ASSY 224	NIV 1			PC	UN	1.000	0.000	
A2137F0429	A2137/0429/01/A	BATHSG+PWBS 224MHZ US	NIV 1			PD	UN	1.000	0.000	
GREASE SIL	GREASE SIL	GREASE SILICONE				PD	UN	0.010	0.000	
M2137F0015	M2137/0015/PA	FLAT SCRENCABLE 20P 0.5				PD	UN	1.000	10.590	
M2137F0024	M2137/0024/PA	FOAM 77X57 DIA				PD	UN	1.000	5.000	
M2137F0025	M2137/0025/PA	FOAM 57X40 DIA				PD	UN	1.000	2.500	
M2137F0026	M2137/0026/PA	FOAM 57DIA				PD	UN	1.000	2.500	
PRS01F0007	PRS01/0007	O RING				PD	UN	1.000	5.950	
PRS02F0041	PRS02/0041	O RING				PD	UN	1.000	4.290	
PRS04F0001	PRS04/0001	RONDELLE ETANCHE				PD	UN	3.000	0.880	
PSC01F0306	PSC01/0306	SCREW TCHC M3*6 NOIRE				PD	UN	6.000	0.108	
PSC01F0450	PSC01/0450	SCREW TCHC M4*50 NOIRE				PD	UN	1.000	0.478	
PSC01F0480	PSC01/0480	SCREW M4*80				PD	UN	2.000	2.500	

Prix de revient : 673.027 Nb de composants : 17 Nb d'article(s) optionnel : 0 PVB : 0.000 %K PVB : V 0.0

Dossier .... : DAT
Depot ..... : 000
Code edition : <GP_NOEDI>

EDITION DES NOMENCLATURES
<LABO >

Date : 05/03/99

Page : 1

KQG RAP2-224

NOMENCLATURE : A2137F0060 / BASE / 001

PRODUIT	: References	: A2137F0060 A2137/0060/01/A	Designation	: FRONT RING ASSY	NIV 1
NOMENCLATURE	: Code / version	: BASE / 001	Design/ type	: NOMENCLATURE DE BASE	/ T
Gammes associees	: de fabrication	:			
	previs. charges	:		! ---- STOCK PRODUIT ----	
Calcul delai	: Quantite fixe de fabrication	: 5.00 / Delai : 15 / Cadencement : 15		! physique :	88.00 UN
DEFINITION	: pour	: 1 produit			

Ref princ.	Ref secondaire	Designation	Specif.	Rep/Plan	Matiere	Type	Unite	Quantite	P.R.M.P	art. remp.
FIL VERTJA	FIL VERTJAUNE	GREEN YELLOW WIRE				PD	UN	0.040	1.124	
M2053F3723	M2053/3723	COLLAR				PD	UN	1.000	12.090	
M2056F0123	M2056/0123/PA/A	FRONT RING				PD	UN	1.000	194.900	
M2137F0079	M2137/0079/PA	DIN CONNECTION PCB				PD	UN	1.000	7.800	
PAD04F0007	PAD04/0007	ADHESIVE 638				PD	UN	0.010	175.110	
PCN02FCAB2	PCN02/CAB2	CAB COAX SFL22LP0456A 90				PD	UN	1.000	49.000	
PCN02FCOAX	PCN02/COAX	PLUG COAX CMS SFL2RSMT				PD	UN	1.000	6.100	
PCN06F1A03	PCN06/1A03	SOCKET				PD	UN	1.000	6.440	
PSC06F0306	PSC06/0306	SCREW PAN HD M3X6 TAPTIT				PD	UN	2.000	0.100	
SOLDERTAG	SOLDERTAG	COSSE A SERTIR				PD	UN	1.000	0.323	

Prix de revient : 276.649 Nb de composants : 10 Nb d'article(s) optionnel : 0 PVB : 0.000 %K PVB : V 0.0

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Depot ..... : 000
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EDITION DES NOMENCLATURES
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Date : 05/03/99

KQG-RMP2-224

NOMENCLATURE : A2137F0094 / BASE / 001

PRODUIT	: References	: A2137F0094 A2137/0094/01/A	Designation	: EMITTER 224MHZ US	NIV 1
NOMENCLATURE	: Code / version	: BASE / 001	Design/ type	: NOMENCLATURE DE BASE	/ T
Gammes associees	: de fabrication	:			
	previs. charges	:		! ---- STOCK PRODUIT ----	
Calcul delai	: Quantite fixe de fabrication	: 5.00 / Delai : 15 / Cadencement : 15		! physique :	10.00 UN
DEFINITION	: pour	: 1 produit			

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A2137F0096	A2137/0096/01/A	SELF 6T 2DIA WIRE0.5	NIV 1			PC	UN	1.000	0.000	
M2137F0093	M2137/0093/PA	RMP2 224MHZ EMITTER PCB				PD	UN	1.000	0.000	
PCN02F5020	PCN02/5020	CONN FLAT CABLE 20W 0.5				PD	UN	1.000	4.800	
PCN02FC0AX	PCN02/C0AX	PLUG COAX CMS SFL2RSMT				PD	UN	2.000	6.100	
PCP04F68M0	PCP04/68M0	CAPA. 68M 10V OSCON SANY				PD	UN	1.000	8.710	
PCP14F02P0	PCP14/02P0	CAPA. 2P 0603				PD	UN	1.000	0.260	
PCP14F04P0	PCP14/04P0	CAPA. 4P 0603				PD	UN	1.000	0.000	
PCP14F05P0	PCP14/05P0	CAPA. 5P 0603				PD	UN	1.000	0.220	
PCP14F07P0	PCP14/07P0	CAPA. 7P 0603				PD	UN	1.000	0.220	
PCP14F100P	PCP14/100P	CAPA. 100P 0603				PD	UN	2.000	0.300	
PCP14F10N0	PCP14/10N0	CAPA. 10N 0603				PD	UN	2.000	0.210	
PCP14F10P1	PCP14/10P1	CAPA. 10P 0603				PD	UN	3.000	0.260	
PCP14F15P1	PCP14/15P1	CAPA. 15P 0603				PD	UN	1.000	0.000	
PCP14F1N03	PCP14/1N03	CAPA. 1N 0603				PD	UN	2.000	0.300	
PCP14F22N0	PCP14/22N0	CAPA. 22N 0805				PD	UN	1.000	0.300	
PCP14F22P1	PCP14/22P1	CAPA. 22P 0603				PD	UN	2.000	0.300	
PCP14F330P	PCP14/330P	CAPA. 330P 0603				PD	UN	2.000	0.300	
PCP14F33P1	PCP14/33P1	CAPA. 33P 0603				PD	UN	6.000	0.260	
PCP14F4N73	PCP14/4N73	CAPA. 4N7 0603				PD	UN	1.000	0.300	
PCP14FM102	PCP14/M102	CAPA. 100N 0603				PD	UN	10.000	0.160	
PCP16F02M2	PCP16/02M2	CAPA. 2M2 10V TANT CMS				PD	UN	2.000	0.000	
PCP16F04M7	PCP16/04M7	CAPA. 4M7 10V TANT CMS				PD	UN	1.000	0.760	
PCT01F08M0	PCT01/08M0	CRYSTAL 8MHZ				PD	UN	1.000	55.000	
PD009F0002	PD009/0002	BAR 216 SOT143				PD	UN	1.000	0.130	
PD012F0002	PD012/0002	BBY31 SOT23				PD	UN	2.000	0.800	
PFT01F10N0	PFT01/10N0	INDUCTOR 10NH				PD	UN	2.000	5.100	
PFT01F22N0	PFT01/22N0	INDUCTOR 22NH				PD	UN	1.000	0.000	
PFT01FPFL5	PFT01/PFL5	SHIELD 30*30*15 PFL5				PD	UN	1.000	38.000	
PML01F1017	PML01/1017	IC UMA1017 SOT266-1				PD	UN	1.000	20.900	
PML01F6300	PML01/6300	IC SA6300 SO8				PD	UN	1.000	16.500	
PMR01F405P	PMR01/405P	REG LP2982 SOT23-5				PD	UN	1.000	3.500	
PMR01F5205	PMR01/5205	REG MIC5205-BM5				PD	UN	1.000	9.130	
PRF35F01K5	PRF35/01K5	RESISTOR 1K5 0603				PD	UN	1.000	0.070	
PRF35F01M0	PRF35/01M0	RESISTOR 1M 0603				PD	UN	1.000	0.070	
PRF35F02K2	PRF35/02K2	RESISTOR 2K2 0603				PD	UN	2.000	0.070	
PRF35F04K7	PRF35/04K7	RESISTOR 4K7 0603				PD	UN	1.000	0.070	
PRF35F100K	PRF35/100K	RESISTOR 100K 0603				PD	UN	2.000	0.070	
PRF35F100R	PRF35/100R	RESISTOR 100R 0603				PD	UN	3.000	0.070	
PRF35F10K0	PRF35/10K0	RESISTOR 10K 0603				PD	UN	2.000	0.070	
PRF35F120K	PRF35/120K	RESISTOR 120K 0603				PD	UN	1.000	0.070	
PRF35F120R	PRF35/120R	RESISTOR 120R 0603				PD	UN	1.000	0.070	
PRF35F12K0	PRF35/12K0	RESISTOR 12K 0603				PD	UN	1.000	0.281	

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Depot ..... : 000
Code edition : <GF_NOEDI>

EDITION DES NOMENCLATURES
<LABO >

Date : 05/03/99

KQG RTR2-224

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PRF35F18K0	PRF35/18K0	RESISTOR 18K 0603				PD	UN	1.000	0.281	
PRF35F18R0	PRF35/18R0	RESISTOR 18R 0603				PD	UN	1.000	0.070	
PRF35F22K0	PRF35/22K0	RESISTOR 22K 0603				PD	UN	1.000	0.070	
PRF35F33K0	PRF35/33K0	RESISTOR 33K 0603				PD	UN	1.000	0.070	
PRF35F33R0	PRF35/33R0	RESISTOR 33R 0603				PD	UN	1.000	0.000	
PRF35F360K	PRF35/360K	RESISTOR 360K 0603				PD	UN	1.000	0.290	
PRF35F47K0	PRF35/47K0	RESISTOR 47K 0603				PD	UN	4.000	0.070	
PRF35F56R0	PRF35/56R0	RESISTOR 56R 0603				PD	UN	1.000	0.000	
PRV04F100K	PRV04/100K	POT.100K CMS MULTI VERT.				PD	UN	1.000	11.630	
PTR02F1002	PTR02/1002	BFR93 SOT23				PD	UN	1.000	1.100	
PTR02FBFTA	PTR02/BFTA	BFT25A SOT93				PD	UN	3.000	0.000	

Prix de revient : 204.542 Nb de composants : 53 Nb d'article(s) option(s) : 0 PVB : 0.000 %K PVB : V 0.0

Dossier .... : DAT
Depot ..... : 000
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EDITION DES NOMENCLATURES
<LABO >

Date : 05/03/99
Page : 1

KQG-RMP2-224

NOMENCLATURE : A2137F0095 / BASE / 001

PRODUIT : References : A2137F0095 A2137/0095/01/A
NOMENCLATURE : Code / version : BASE / 001
Gammes associees : de fabrication :
previs. charges :
Calcul delai : Quantite fixe de fabrication : 5.00 / Delai : 15 / Cadencement : 15
DEFINITION : pour : 1 produit

Designation : CERAMIC SLEEVE ASSY 224 NIV 1
Design/ type : NOMENCLATURE DE BASE / T

! ---- STOCK PRODUIT ----
! physique : -2.00 UN

Ref princ.	Ref secondaire	Designation	Specif.	Rep/Plan	Matiere	Type	Unite	Quantite	P.R.M.P	Art. remp
A2137F0098	A2137/0098/01/A	ANTENNA BASE RMP2 224MHZ NIV 1				PC	UN	1.000	0.000	
M2056F0125	M2056/0125/PA/C	CERAMIC SLEEVE				PD	UN	1.000	315.270	

Prix de revient : 315.270 Nb de composants : 2 Nb d'article(s) option(s) : 0 PVB : 0.000 %K PVB : V 0.0

RENISHAW

TITLE: RADIO PROBE LOGIC PWB

PARTS LIST

SERIAL NUMBERED PARTS: NO

A-2137-0520-03-A

ISSUE DATE:

PART NUMBER	PART DESCRIPTION	UM	QTY PER	REFERENCE DATA	TYPE	WORK CENTRE
A-2137-0013-02	SM RMP2 FPGA		1	IC2		
A-2137-0562-02	TRANSFORMER		1	T1		
M-2137-0521-02	RADIO PROBE LOGIC PWB		1			
P-CN02-5006	PLG HED 6W SM		1	PL1		
P-CN02-5020	SKT FLEX 20W SM HOR		2	SK1 SK2		
P-CP14-1N03	SM CAP 1nF 0603 5% NPO 50V		1	C12		
P-CP14-33P0	SM CAP 33p 0805 5% NPO 100V		3	C4 C5 C16		
P-CP14-47P0	SM CAP 47p 0805 5% NPO 100V		2	C1 C2		
P-CP14-4N71	SM CAP 4n7 0805 10% X7R 50V		1	C18		
P-CP14-M102	SM CAP 100nF 0603 5% NPO 50V		9	C3 C6 C7 C8 C9 C11 C14 C15 C17		
P-CP14-N221	SM CAP 1nF 0603 5% NPO 50V		1	C13		
P-CP16-1M00	SM CAP 1u A 10% TANT 16V		1	C10		
P-CT02-0013	SM CERAMIC RESONATOR 1mHz +-0.		1	XT1		
P-CT04-0003	SM XTAL 4.0MHz 50ppm		1	XT2		
P-DD09-0002	SM DIODE 75V 250mA		8	D1 D2 D3 D4 D5 D6 D7 D8		
P-MF01-1087	SM VOLTAGE MONITOR 4.38V		1	IC1		
P-ML01-1068	SM LP324 OPAMP QUAD VFB		1	IC4		
P-MP10-1684	SM UCONT 8BIT 10MHz PIC16F84		1	IC3		
P-RF35-001M	SM RES 1M 0603 1% 200ppm		1	R11		
P-RF35-010K	SM RES 10K 0603 1% 200ppm		1	R20		
P-RF35-01K0	SM RES 1K0 0603 1% 200ppm		1	R14		
P-RF35-01M2	SM RES 1M2 0603 1% 200ppm		3	R19 R46 ~~D50~~		
P-RF35-02M2	SM RES 2M2 0603 5% 200ppm		1	R44 R50		
P-RF35-03K3	SM RES 3K3 0603 1% 200ppm		2	R39 R58		
P-RF35-047K	SM RES 47K 0603 1% 200ppm		6	R2 R7 R12 R23 R32 R37		
P-RF35-04M7	SM RES 4M7 0603 5% 200ppm		2	R17 R24		
P-RF35-07K5	SM RES 7K5 0603 1% 200ppm		1	R57		
P-RF35-100K	SM RES 100K 0603 1% 200ppm		8	R10 R22 R27 R38 R40 R52 R53 R54		
P-RF35-10M0	SM RES 10M 0603 5% 200ppm		1	R15		
P-RF35-120K	SM RES 120K 0603 1% 200ppm		6	R1 R8 R9 R25 R26 R31		

SHEET 1 of 2

FIRST ISSUE No.: 547

COMPILED BY: JRW

DATE: 1.10.97

CHECKED BY: BP

6 USED

6 USED

KQ6 RMP2-224

RENISHAW

TITLE: RADIO PROBE LOGIC PWB

PARTS LIST

SERIAL NUMBERED PART? NO

A-2137-0520-03-A

ISSUE DATE:

SHEET 2 of 2

FIRST ISSUE No. 547

COMPILED BY JRW

DATE 1.10.97

CHECKED BY DP

PART NUMBER	PART DESCRIPTION	UM	QTY PER	REFERENCE DATA	USE	WORK CENTRE
P-RF35-15K0	SM RES 15K 0603 1% 200ppm		1	R40		
P-RF35-160K	SM RES 160K 0603 1% 200ppm		1	R45		
P-RF35-220R	SM RES 220R 0603 1% 200ppm		1	R42		
P-RF35-27K0	SM RES 27K 0603 1% 200ppm		8	R4 R5 R16 R18 R34 R35 R41 R56		
P-RF35-33K0	SM RES 33K 0603 1% 200ppm		6	R3 R6 R13 R21 R33 R36		
P-RF35-39K0	SM RES 39K 0603 1% 200ppm		1	R55		
P-RF35-470K	SM RES 470K 0603 1% 200ppm		3	R43 R49 R51		
P-RF35-560K	SM RES 560K 0603 1% 200ppm		1	R29		
P-RF35-680K	SM RES 680K 0603 1% 200ppm		1	R47		
P-RF35-68K0	SM RES 68K 0603 1% 200ppm		1	R20		
P-RF35-750K	SM RES 750K 0603 1% 200ppm		1	R30		
P-TR02-1006	SM TRANSISTOR BC817 NPN		1	TR3		
P-TR03-1025	SM TRANSISTOR ZVN4106F N-FET		1	TR2		
P-TR03-1035	SM TRANSISTOR BRY61 UNIJCT		1	TR1		
T00042-02	PASTETOOL		REF			
C-2137-0520-03	CIRCUIT DIAGRAM		REF			
T-2137-0520-02	TEST POINT DRAWING		REF			

KQG RTP2-224

RENISHAW

TITLE: RADIO PROBE POWER PWB

PARTS LIST

SERIAL NUMBERED PART? NO

A-2137-0500-04-A

ISSUE DATE:

PART NUMBER	PART DESCRIPTION	UM	QTY PER	REFERENCE DATA	TYPE	WORK CENTRE
A-2085-0089-02	POT CORE INDUCTOR ASSY - 52mH		1	L1		
A-2137-0560-01	POT CORE INDUCTOR ASSY - 250uH		1	L2		
M-2137-0501-04	RADIO PROBE POWER PWB		1			
P-CN02-5008	PLG HED 2W SM 900		2	PL1 PL2		
P-CN02-5020	SKT FLEX 20W SM HOR		1	SK1		
P-CP01-N224	CAP 220p 10% N4700 TC 500V		2	C12 C13		
P-CP04-68M0	CAP AL 68uF 10V 20% RAD		1	C23		
P-CP14-03N3	SM CAP 3n3 1210 1% NPO 50V		1	C6		
P-CP14-04N7	SM CAP 4n7 1210 1% NPO 50V		1	C7		
P-CP14-1N03	SM CAP 1nF 0603 5% NPO 50V		1	C24		
P-CP14-2N21	SM CAP 2.2nF 0603 5% NPO 50V		3	C16 C17 C20		
P-CP14-4N73	SM CAP 4n7 0603 10% X7R 50V		2	C28 C29		
P-CP14-M102	SM CAP 100nF 0603 5% NPO 50V		8	C1 C2 C3 C4 C9 C14 C15 C27		
P-CP14-N221	SM CAP ~~1nF~~ 220pF 0603 5% NPO 50V		4	C8 C10 C25 C30		
P-CP15-100M	CAP AL 100uF 10V 20% SM		1	C19		
P-CP16-03M3	SM CAP 3u3 B TANT 16V		1	C11		
P-CP16-1M00	SM CAP 1u A 10% TANT 16V		2	C5 C18		
P-CP16-22M1	SM CAP 22u D 10% TANT 16V		1	C21		
P-CP16-6M80	SM CAP 6u8 C 10% TANT 16V		1	C22		
P-DD07-012V	SM DIODE Zener 12V 5% 300mW		1	D27		
P-DD07-04V7	SM DIODE ZENER 4V7 5% 500mW		1	D13		
P-DD08-0003	SM DIODE SCHOTTY 40V 1.0A		1	D17		
P-DD08-0004	SM DIODE SCHOTTKY 30V 200mA		11	D3 D6 D8 D9 D10 D19 D21 D22 D23 D24 D25		
P-DD09-0002	SM DIODE 75V 250mA		8	D2 D4 D5 D7 D11 D12 D14 D20		
P-FT03-0005	SM Trans Supp 14V 40A 1206		2	VDR1 VDR2		
P-MF01-1057	SM 7665S O/U VOLTAGE DETECTOR		1	IC5		
P-ML10-0013	SM MAX4515 AN-SW SPST N/C		1	IC3		
P-MR01-405P	SM LP2982 VOLT REG +5V 50mA		3	IC1 IC2 IC4		
P-MR05-0003	SM MAX750A SWIT REG SADJ .45A		1	VR1		

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FIRST ISSUE No.: 547

COMPILED BY: JRW

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ENISHAW

TITLE: RADIO PROBE POWER PWB

PARTS LIST

SERIAL NUMBERED PART? NO

A-2137-0500-04-A

ISSUE DATE:

SHEET 2 of 2

FIRST ISSUE No. 547

COMPILED BY JRW

DATE 22.9.97

CHECKED BY BP

PART NUMBER	PART DESCRIPTION	UM	QTY PER	REFERENCE DATA	TYPE	WORK CENTRE
P-RF35-001M	SM RES 1M 0603 1% 200ppm		6	R3 R6 R7 R20 R39 R42		
P-RF35-010K	SM RES 10K 0603 1% 200ppm		1	R30		
P-RF35-012K	SM RES 12K 0603 1% 200ppm		1	R16		
P-RF35-01K0	SM RES 1K0 0603 1% 200ppm		1	R21		
P-RF35-01K5	SM RES 1K5 0603 1% 200ppm		1	R1		
P-RF35-02K2	SM RES 2K2 0603 1% 200ppm		2	R22 R33		
P-RF35-02M2	SM RES 2M2 0603 5% 200ppm		2	R8 R38		
P-RF35-033R	SM RES 33R 0603 2% 200ppm		1	R28		
P-RF35-047K	SM RES 47K 0603 1% 200ppm		1	R32		
P-RF35-047R	SM RES 47R 0603 2% 200ppm		1	R25		
P-RF35-04K7	SM RES 4K7 0603 1% 200ppm		1	R44		
P-RF35-04M7	SM RES 4M7 0603 5% 200ppm		1	R12		
P-RF35-05M6	SM RES 5M6 0603 5% 200ppm		2	R10 R23		
P-RF35-06M8	SM RES 6M8 0603 5% 200ppm		2	R9 R41		
P-RF35-08M2	SM RES 8M2 0603 5% 200ppm		1	R26		
P-RF35-100K	SM RES 100K 0603 1% 200ppm		6	R4 R5 R13 R15 R24 R37		
P-RF35-100R	SM RES 100R 0603 1% 200ppm		1	R14		
P-RF35-10M0	SM RES 10M 0603 5% 200ppm		1	R40		
P-RF35-150K	SM RES 150K 0603 1% 200ppm		1	R11		
P-RF35-270K	SM RES 270K 0603 200ppm		3	R19 R29 R35		
P-RF35-300K	SM RES 300K 0603 1% 200ppm		1	R27		
P-RF35-470K	SM RES 470K 0603 1% 200ppm		5	R17 R18 R31 R34 R43		
P-RF35-680K	SM RES 680K 0603 1% 200ppm		1	R2		
P-RV04-100K	SM TRIM 100K 10% 0.25W 100ppm		2	RV1 RV2		
P-TR03-1025	SM TRANSISTOR ZVN4106F N-FET		1	TR2		
P-TR03-1034	SM TRANSISTOR VP0610T P-FET		2	TR1 TR4		
P-TR03-1040	SM TRANSISTOR BC850 NPN		3	TR3 TR6 TR9		
P-TR03-1041	SM TRANSISTOR BC860C PNP		2	TR5 TR7		
P-TR03-1049	SM N-FET IRLML2803 30V 0.73A		1	TR8		
T80041-03	PASTETOOL		REF			
C-2137-0500-04	CIRCUIT DIAGRAM		REF			
D-2137-0500-04	TEST POINT DRAWING		REF			

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ANNEX B

TEST EQUIPMENT LIST

INSTRUMENT	SUPPLIER	TYPE No	SERIAL No	TRL EMC No
LF / HF RECEIVER, 9kHz - 30MHz	ROHDE&SCHWARZ	ESH2	879014 / 028	TRL 06
RF PULSE LIMITER	ROHDE&SCHWARZ	ESH3Z2	M494	TRL 06A
AE, LOOP, Z2, 9kHz - 30MHz	ROHDE&SCHWARZ	HFH2	881058 - 53	TRL 07
RANGE 1 (3 - 30m)	TRL	N/A	N/A	TRL 08
VARIAC, 230V, 10A	ZENITH	100R	V265537	TRL 12
dc PSU, VARIABLE, 30v, 10A, 300W	TOPWARD ELECTRONIC	23010	899672	TRL 15
RF SIGNAL GEN, 10kHz - 1000MHz	MARCONI	2022	119022 / 205	TRL 17
LISN, ac MAINS	CHASE	MN2050	1431	TRL 25
HF RECEIVER, 150kHz - 30MHz	CHASE	HFR2000	2158	TRL 26
LF RECEIVER, 9kHz - 150kHz	CHASE	LFR1000	1020	TRL 27
HF RECEIVER, 150kHz - 30MHz	CHASE	HFR2000	2187	TRL 28
AE, DIPOLE, 20MHz - 300MHz	CHASE	VHA9103	7106	TRL 35
AE, DIPOLE, 20MHz - 300MHz	CHASE	VHA9103	7011	TRL 36
AE, DIPOLE, 300MHz - 1GHz	CHASE	VHA9105	7107	TRL 37
AE, DIPOLE, 300MHz - 1GHz	CHASE	VHA9105	N/A	TRL 38
ATU, RECEIVER, 9kHz - 30MHz	SCHWARZBECK	FMZL1514	1514338	TRL 42
COAX LOAD, 2W, N, 50Ω, dc - 4GHz	BIRD	8360NM	N/A	TRL 113
COAX LOAD, 2W, N, 50Ω, dc - 4GHz	BIRD	8360NM	N/A	TRL 114
COAX LOAD, 2W, BNC, 50Ω, dc - 4GHz	BIRD	8360B	N/A	TRL 115
COAX LOAD, 2W, BNC, 50Ω, dc - 4GHz	BIRD	8360B	N/A	TRL 116
COAX LOAD, 1W, BNC, 50Ω, dc - 1GHz (min)	SUHNER	65BNC - 50 - 0 - 1	N/A	TRL 117
AE, DRG HORN, 1GHz - 18GHz	EMCO	3115	9010 - 3580	TRL 138
AE, DRG HORN, 1GHz - 18GHz	EMCO	3115	9010 - 3581	TRL 139

ANNEX B

TEST EQUIPMENT LIST

INSTRUMENT	SUPPLIER	TYPE No	SERIAL No	TRL EMC No
RF ANALYSER, 10kHz - 60GHz	TEKTRONIX	2756P	B010109	TRL 164
MULTIMETER (mc) 20kΩ / V (sens)	AVO	MODEL 8, MK.V.	0545248	TRL 169
RF SIGNAL GEN, LOW NOISE -90dBc, 10kHz - 5.4GHz	MARCONI	2042	119388 / 080	TRL 176
RANGE 2 (3 - 10m)	TRL	N/A	N/A	TRL 182
VARIAC, 230V, 10A	VARATRAN	Z710R	N/A	TRL 186
ANTENNA MAST	CHASE	HM9104	N/A	TRL 189
MULTIMETER (dig)	ISOTECH	IDM91	00606606	TRL 190
THERMOMETER & HYGROMETER	RS	212 - 146	N/A	TRL 191
AE, BICONE, 20MHz - 300MHz	CHASE	BBA 9106	N/A	TRL 193
SCOPE, 20MHz, 2CH, DIG STORAGE	BECKMAN	9302	2090044	TRL 197
AE, LOG PERIODIC, 300MHz - 1GHz	CHASE	UPA6108	1061	TRL 203
ac PSU, VARIABLE, 300V, 5A, 1kVA, 45Hz - 440Hz	MAGNUS	MP500	1108	TRL 204
TRANSFORMER, ISOLATION, 240Vac	RS	209 - 099	N/A	TRL 205
TRANSFORMER, ISOLATION, 110Vac	RS	208 - 636	N/A	TRL 206
LISN, 3ph MAINS ac	SCHWARZBECK	NSKL8128	8128151	TRL 207
COAX LOAD, 5W, BNC, 50Ω, dc - 4GHz	BIRD	80BNCM	5866	TRL 223
dc PSU, VARIABLE, 15/30V, 2/1A, 30W	WIER	731	88829	TRL 224
VARIAC, 230V, 2A	REGULAC	RB3 - MT	N/A	TRL 225
VARIAC, 230V, 2A	REGULAC	RB3 - MT	N/A	TRL 226
THERMOMETER & HYGROMETER	RS	212 - 124	227	TRL 227
THERMOMETER & HYGROMETER	RS	212 - 124	228	TRL 228
THERMOMETER & HYGROMETER	RS	212 - 124	229	TRL 229
THERMOMETER & HYGROMETER	RS	212 - 124	230	TRL 230
THERMOMETER & HYGROMETER	RS	212 - 124	231	TRL 231

ANNEX B

TEST EQUIPMENT LIST

INSTRUMENT	SUPPLIER	TYPE No	SERIAL No	TRL EMC No
AE, LOG PERIODIC, 300MHz - 1GHz	EMCO	3146	N/A	TRL 233
dc PSU, VARIABLE, (2x) 32V, 3A, 100W	THURLBY THANDAR	PL330	046542	TRL 235
LF / HF RECEIVER, 9kHz - 30MHz	ROHDE&SCHWARZ	ESHS20	837960 / 003	TRL 237
LISN, ac MAINS	ROHDE&SCHWARZ	ESHS3 - Z5	839135 / 013	TRL 238
MULTIMETER, (dig)	ISOTECH	IDM97	32202147	TRL 239
THERMOMETER & BAROMETER	RS	216435	N/A	TRL 240
COAX CABLE, 50Ω, 18GHz, TNC, 1.25m	W L GORE	3390 / 265 / 1	8420202	TRL 249
COAX CABLE, 50Ω, 18GHz, TNC, 1.25m	W L GORE	3390 / 265 / 1	8420223	TRL 250
AE, BICONE, 20MHz - 300MHz	CHASE	VBA6106A	1193	TRL 251
AE, EASY 1, 30MHz - 1GHz	FARNELL	S30280	017	TRL 253
RF SIGNAL GEN, LOW NOISE -90dBc, 10kHz - 5.4GHz	MARCONI	2042	119562 / 021	TRL 254
SCOPE, 400MHz, 4CH, DIG STORAGE	TEKTRONIX	TDS460A	B020781	TRL 258
RF SIGNAL GEN, 10kHz - 1GHz	MARCONI	2022D	119224 - 023	TRL 264
MULTIMETER, (dig)	ISOTECH	IDM97 RMS	32202307	TRL 273
AE, BILOG, 20MHz - 2GHz	CHASE	CBL6112	2098	TRL 274
COAX ADAPTOR, 18GHz, TNC / N	ROSENBERGER	05S106 - K0053	N/A	TRL 275
COAX ADAPTOR, 18GHz, TNC / N	ROSENBERGER	05S106 - K0053	N/A	TRL 276
COAX ADAPTOR, 18GHz, TNC / N	ROSENBERGER	05S106 - K0053	N/A	TRL 277
COAX ADAPTOR, 18GHz, TNC / N	ROSENBERGER	05S106 - K0053	N/A	TRL 278
COAX CABLE, 18GHz, N, 0.5M	ROSENBERGER	RTK161 - GP - Nm90 - 50cms	N/A	TRL 279
COAX CABLE, 18GHz, N, 3.0M	ROSENBERGER	RTK161 - GP - Nm90 - 300cms	N/A	TRL 280
COAX CABLE, 50Ω, 4GHz, N, 12m	TRL	WESTFLEX 103	N/A	TRL 286
COAX CABLE, 50Ω, 4GHz, N, 12m	TRL	WESTFLEX 103	N/A	TRL 287
LISN, ac MAINS	ROHDE&SCHWARZ	ESH3 - Z5	837469 / 010	TRL 289

ANNEX B

TEST EQUIPMENT LIST

INSTRUMENT	SUPPLIER	TYPE No	SERIAL No	TRL EMC No
AE, BILOG, 20MHz - 1GHz	CHASE	CBL6111B	1945	TRL 290
MULTIMETER (dig)	ISOTECH	IDM97 RMS	32202547	TRL 291
MULTIMETER (dig)	ISOTECH	IDM97 RMS	32202565	TRL 292
THERMOMETER & BAROMETER	RS	216435	N/A	TRL 293
COAX CABLE, 50Ω, 26.5GHz, SMA, 2m, c/w 3 ADAPTORS	GORE	145	MFR65474	TRL 308
V / UHF RECEIVER, 20MHz - 1GHz	ROHDE&SCHWARZ	ESVS10	837948 / 003	TRL 317
RF PULSE LIMITER	ROHDE&SCHWARZ	ESH3Z2	A400	TRL 318
RF SIGNAL GEN, 9kHz - 1.2GHz	MARCONI	2023	112224 / 036	TRL 320
AE, LOG PERIODIC, 300MHz - 1GHz	CHASE	UPA6108	1016	TRL 344
V / UHF RECEIVER, 20MHz - 1GHz	ROHDE&SCHWARZ	ESVS10	844594 / 0003	TRL 352
LF / HF RECEIVER, 9kHz - 30MHz	ROHDE&SCHWARZ	ESHS10	844077 / 019	TRL 353
COAX CABLE, 50Ω, 4GHz, N, 0.5m	TRL	NA	NA	TRL 358
COAX CABLE, 50Ω, 4GHz, N, 16m	TRL	NA	NA	TRL 359
COAX CABLE, 50Ω, 4GHz, N, 1m	TRL	NA	NA	TRL 360
THERMOMETER & HYGROMETER	RS	204 - 072	NA	TRL 363
THERMOMETER & HYGROMETER	RS	204 - 072	NA	TRL 364
THERMOMETER & HYGROMETER	RS	204 - 072	NA	TRL 365
THERMOMETER & HYGROMETER	RS	204 - 072	NA	TRL 366
V / UHF RECEIVER, 20MHz - 1GHz	ROHDE&SCHWARZ	ESVS20	838804 / 005	TRL 415
RF ANALYSER, 9kHz - 1GHz	WAYNE KERR	SSA1000A	9800001488	TRL 416
LF / HF RECEIVER, 9kHz - 30MHz	ROHDE&SCHWARZ	ESHS10	830051 / 001	TRLUH 03
AE, LOOP, Z2, 9kHz - 30MHz	ROHDE&SCHWARZ	HFH - Z2	892246 / 023	TRLUH 23
RF ANALYSER, dc - 26.5GHz	MARCONI	2380	152089 / 009	TRLUH 120
		2386	152076 / 044	

ANNEX C

APPLICANT'S SUBMISSION OF DOCUMENTATION LIST

a.	FEDERAL COMMUNICATIONS COMMISSION	- APPLICATION	[X]
		- FEE	[X]
b.	AGENT'S LETTER OF AUTHORISATION		[X]
c.	MODEL(s) vs IDENTITY		[X]
d.	ALTERNATIVE TRADE NAME DECLARATION(s)		[ ]
e.	LABELLING	- PHOTOGRAPHS	[X]
		- DECLARATION	[X]
		- DRAWINGS	[X]
f.	TECHNICAL DESCRIPTION		[X]
g.	BLOCK DIAGRAMS	- Tx	[X]
		- PSU	[ ]
h.	CIRCUIT DIAGRAMS	- Tx	[X]
		- PSU	[ ]
i.	COMPONENT LOCATION	- Tx	[X]
		- PSU	[ ]
j.	PCB TRACK LAYOUT	- Tx	[X]
		- PSU	[ ]
k.	BILL OF MATERIALS	- Tx	[X]
		- PSU	[ ]
l.	USER INSTALLATION / OPERATING INSTRUCTIONS		[X]