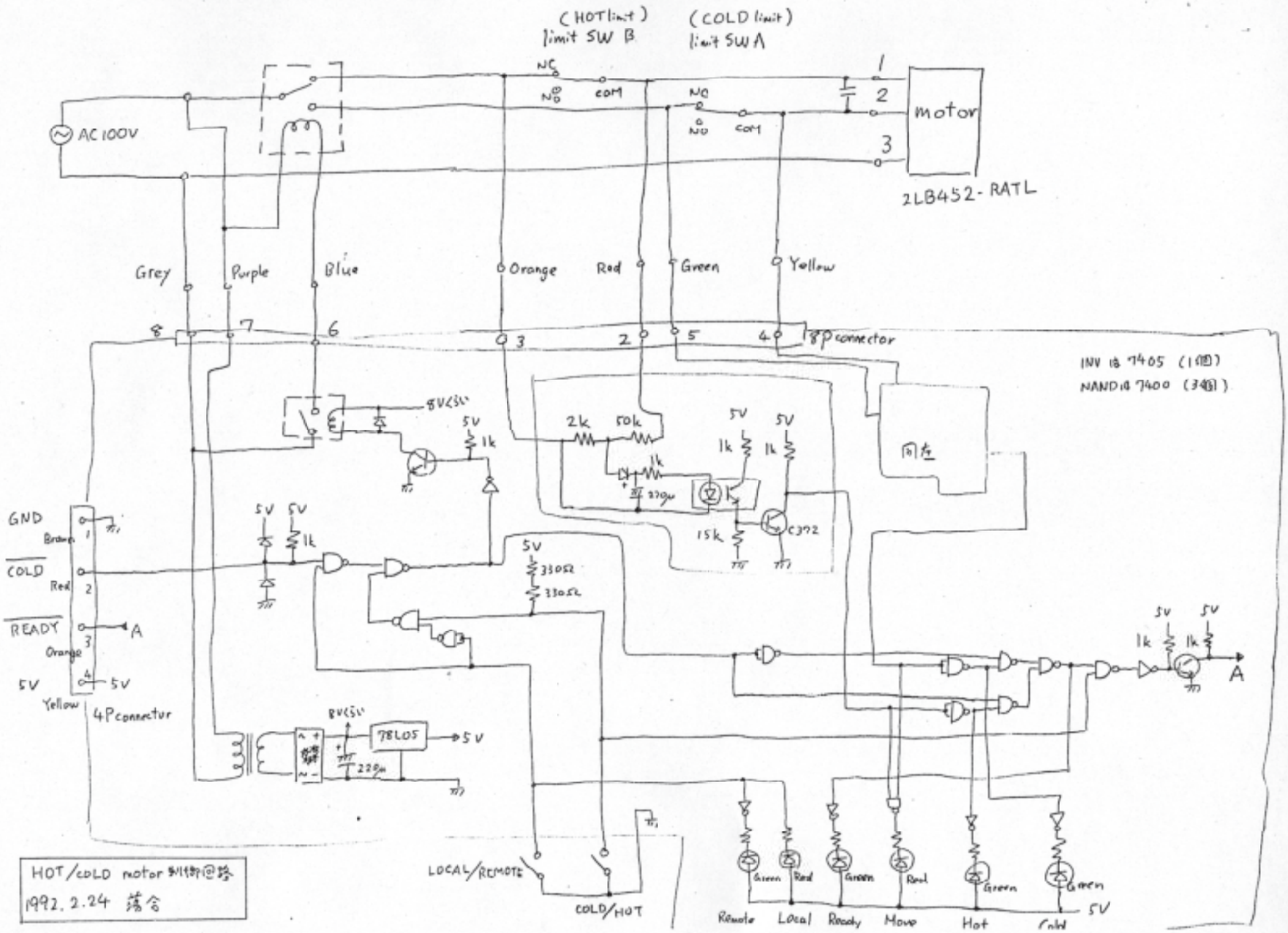

(HOT limit)
limit SW B
(COLD limit)
limit SW A
NC
NO
COM
NO
COM
1
2
3
motor
2LB452-RATL
AC 100V
Grey
Purple
Blue
Orange
Red
Green
Yellow
8
7
6
3
2
5
4
8P connector
INV is 7405 (1個)
NAND is 7400 (3個)
8V<5V
5V
1k
2k
50k
1k
220μ
5V
5V
1k
1k
15k
C372
GND
Brown
1
COLD
Red
2
READY
Orange
3
A
5V
4
5V
Yellow
4P connector
5V
5V
1k
5V
330Ω
330Ω
5V
1k
1k
A
8V<5V
78L05
5V
220μ
LOCAL/REMOTE
COLD/HOT
Green
Red
Green
Red
Green
Green
Remote
Local
Ready
Move
Hot
Cold
5V
HOT/COLD motor 制御回路
1992. 2. 24 落合

林　正彦　様

COMMUNICATIONS RESEARCH LABORATORY

1992年　2月　25日

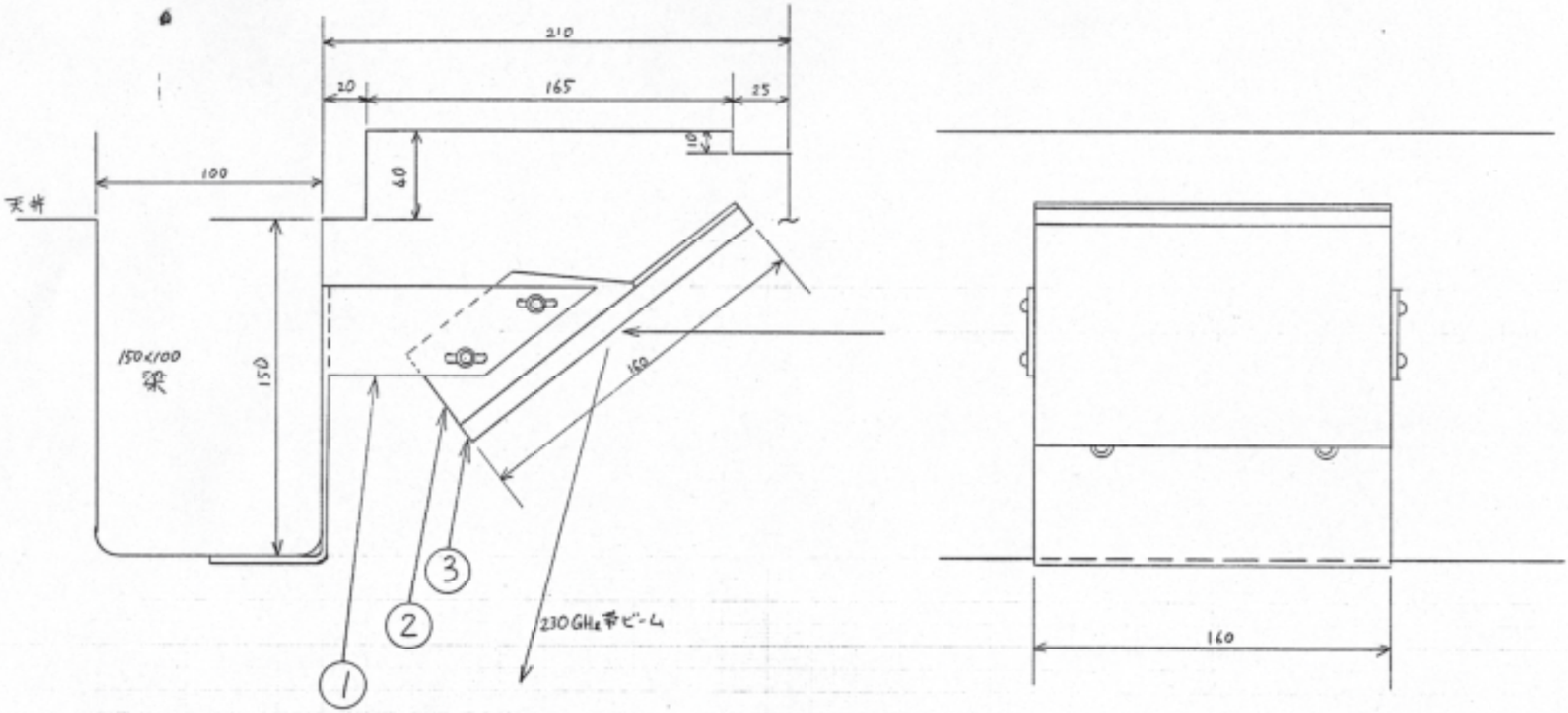
この度の観測では大変お世話になりました。ありがとうございました。観測も無事終了し、おかげさまでたくさんのデータを取ることができました。みな様の貴重な観測の時間をさいていただき、感謝しております。どうぞみな様によろしくお伝えいただきますようお願いいたします。長谷川先生には別にお電話でお礼申し上げますが、よろしくお伝え下さい。

増子治信

ワインを買いましたのでみな様でめし上って下さい。

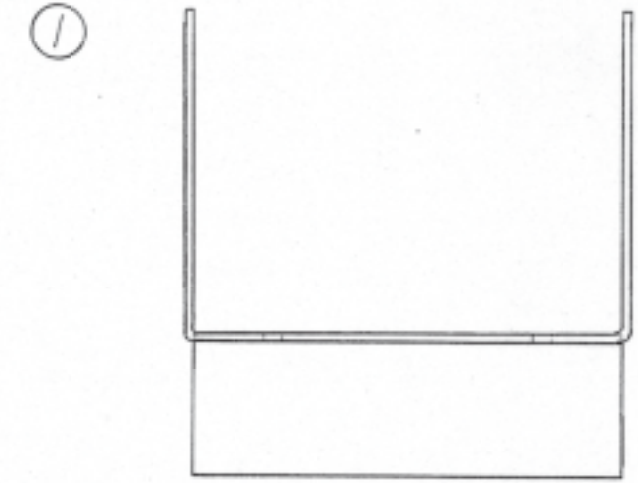
おまけ　HOT/COLDの設計図（実物とすかうとこてある）を一部かいてみます　落合
観測結果はまとめて郵送します

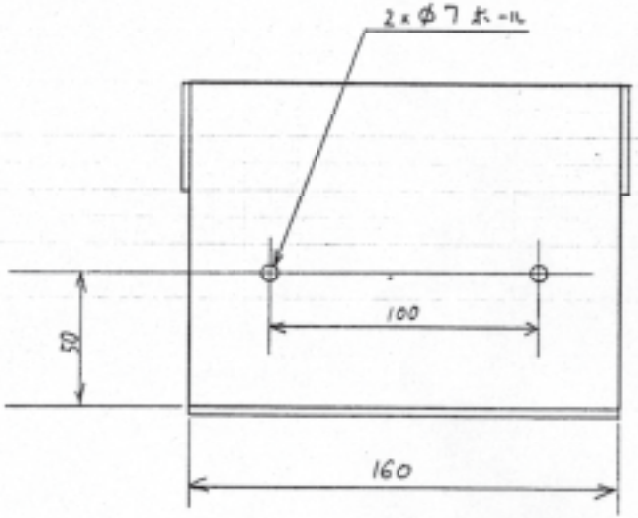
郵政省 通信総合研究所
184 東京都小金井市貫井北町4-2-1
TEL.(0423)21-1211代

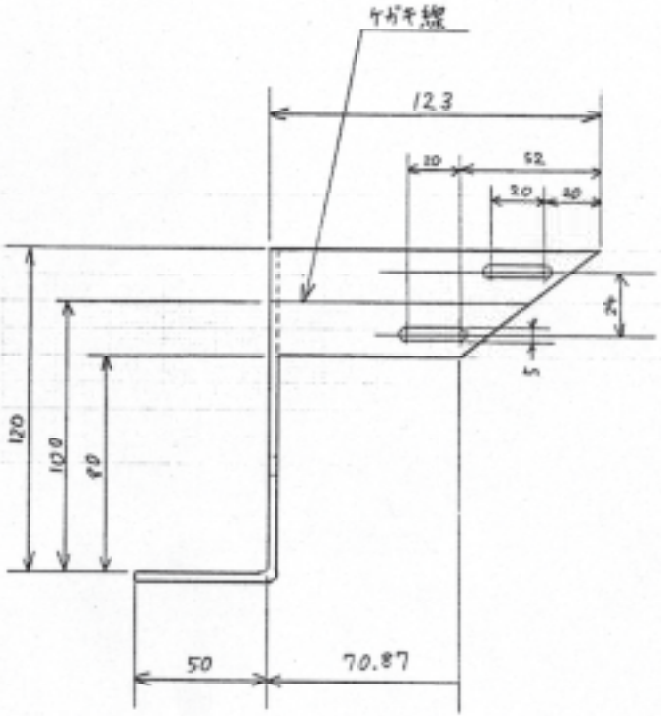


東大60cm望遠鏡 HOT/COLD 用 ミラー	縮尺 1/2 (A3ori)	1992.2.13	落合

①

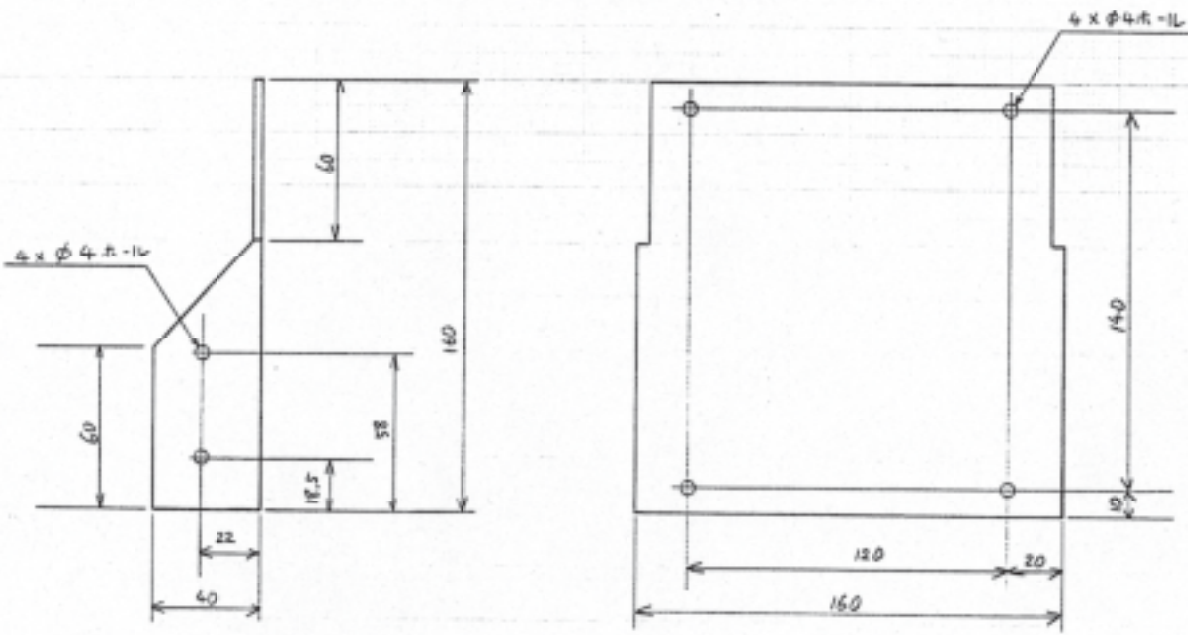






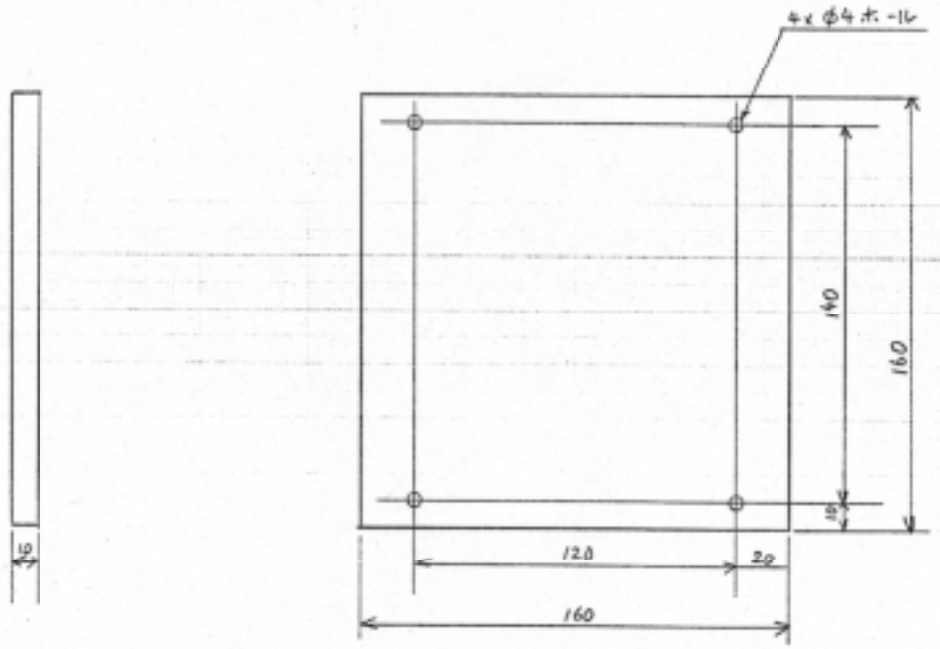
東大 60mm 型連鉄 HOT/COLD 用ミラー	部品 1	縮尺 1/1 (A3×4)	1992.2.13 清合

②

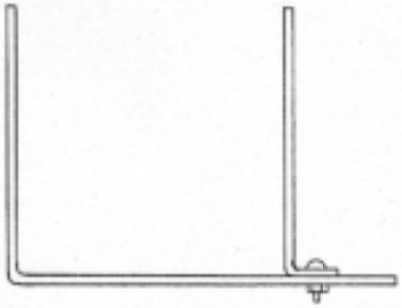


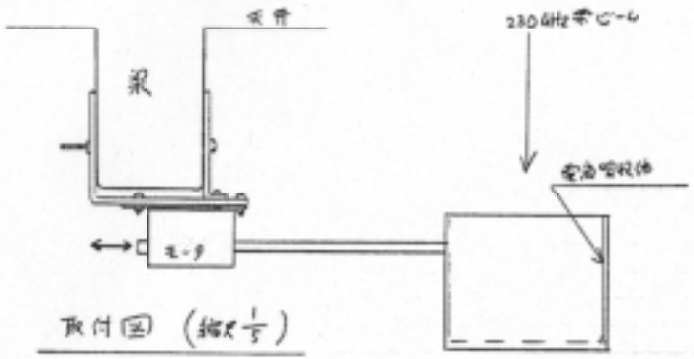
東大 60cm 望遠鏡 HOT/COLD 用ミラー	部品 2	縮尺 1/2 (A3ノビ)	1992.2.13	藤谷

③

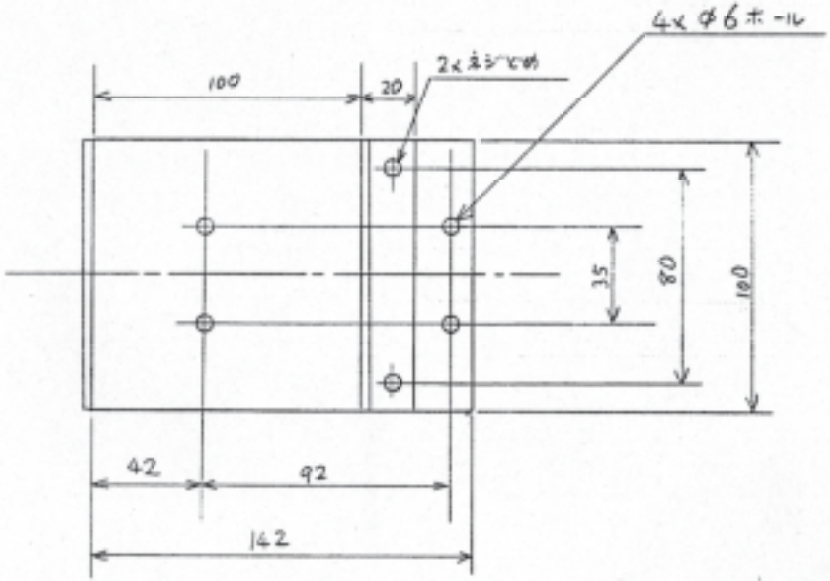


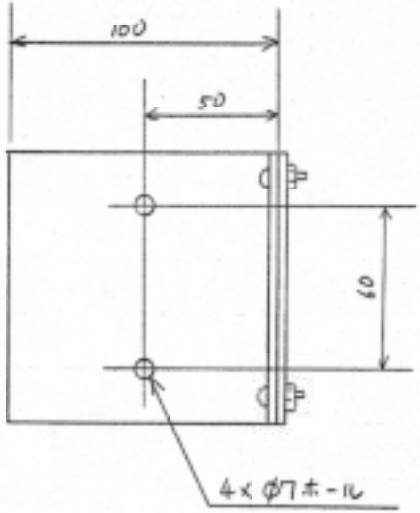
東大 60cm 望遠鏡 HOT/COLD 用ミラー	部品 3	縮尺 1/2 (A3 ノビ)	1992. 2. 17 荻野



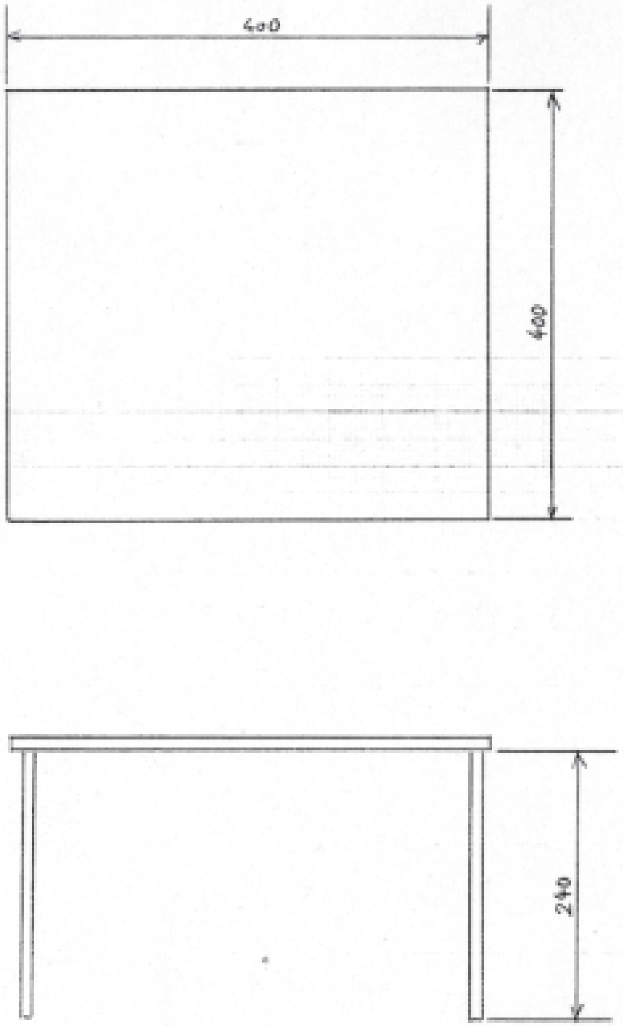


取付図 (縮尺 $\frac{1}{5}$)

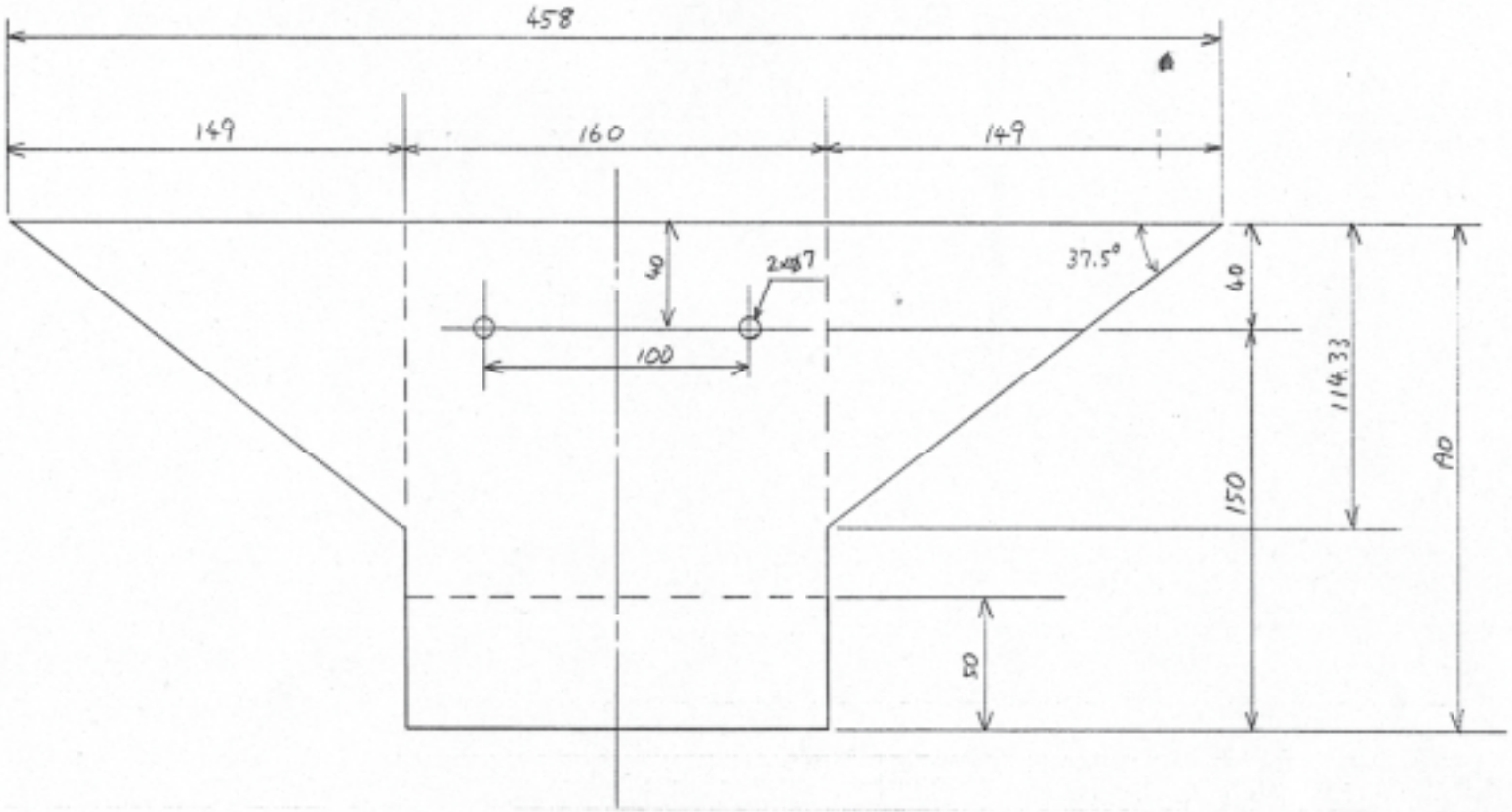




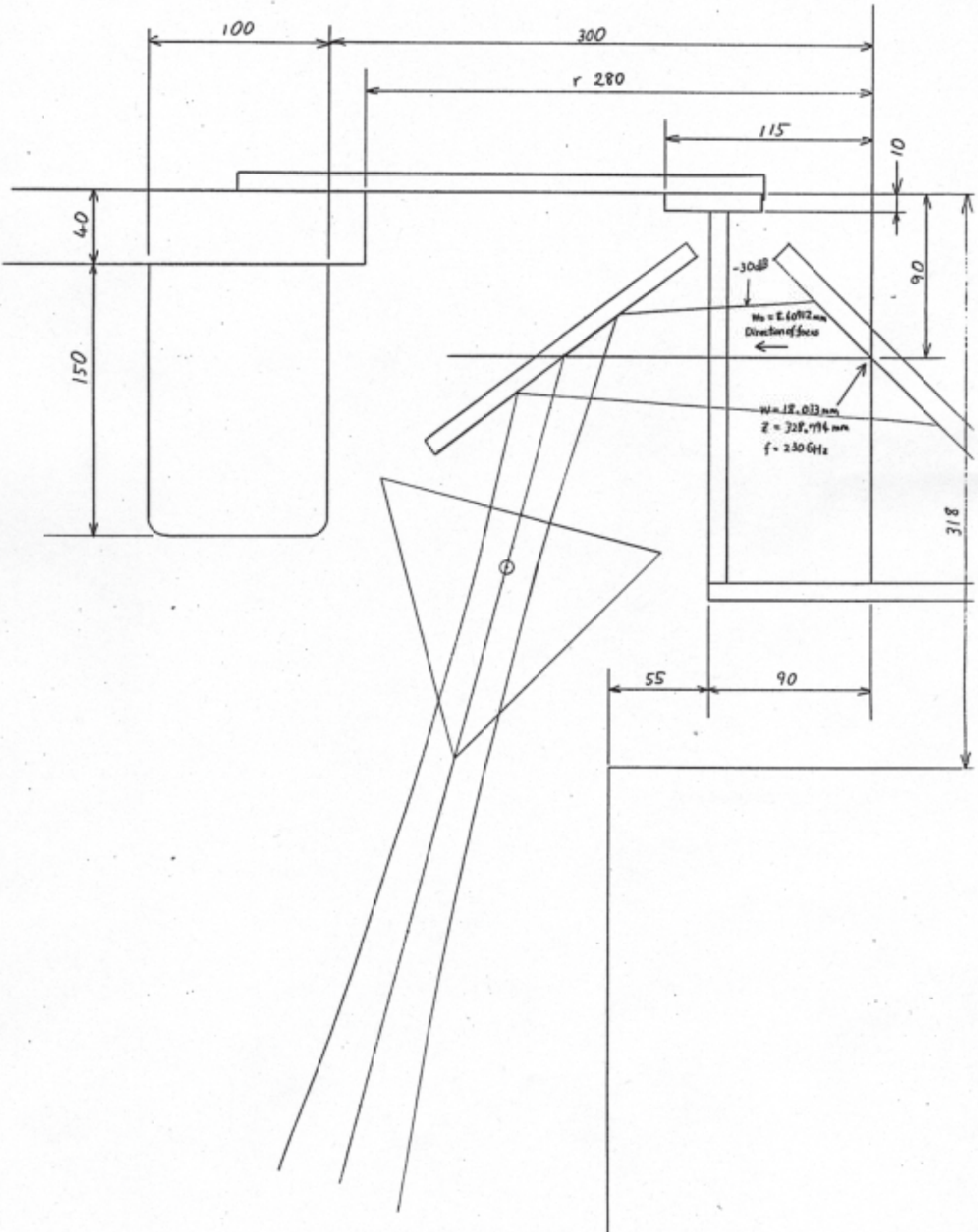
東大 60cm HOT/COLD スイッチモータ取付金具	縮尺 $\frac{1}{2}$ (A3ノビ)	1992. 2. 13 薄合



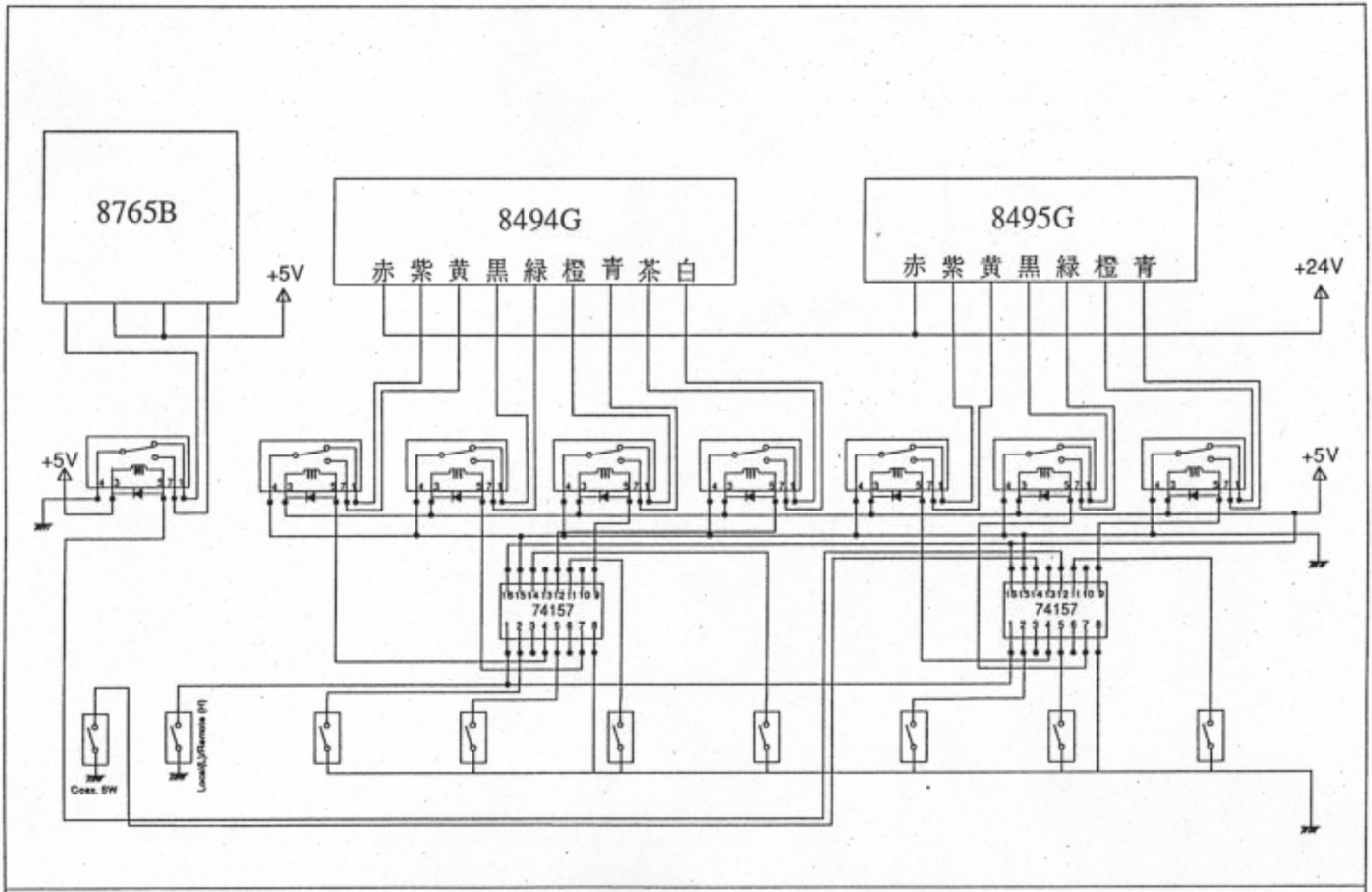
[illegible] 60mm HOT/COLD デュワー テーブル	1992.2.13 [illegible]



1992 7.14



直大 60cm 望遠鏡 HOT/COLD LOAD SW 付近	縮尺 1/2 (A3のとき)	1992.2.7 高倉



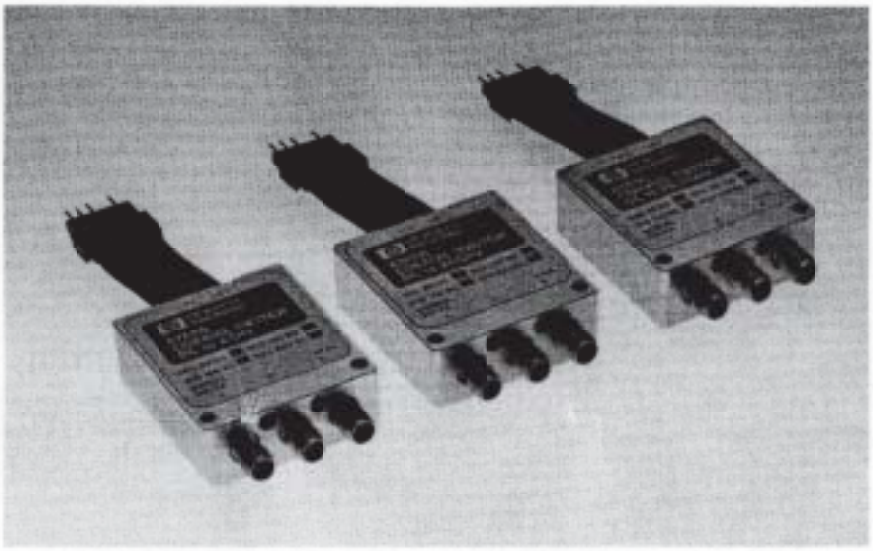
IF Attenuator Remote Control Circuit 1992/2/28 菊地信弘

HEWLETT PACKARD

HP 8765A/B/C Microwave SPDT Switches

DC - 4, 20, 26.5 GHz

Technical Data



Features and Description

- High Isolation
- Exceptional reliability, long life
- Excellent repeatability
- Unterminated

The HP 8765 family of switches is designed for microwave instrumentation and ATE systems use and features excellent electrical and mechanical performance. The HP 8765A comes with SMA connectors for use from DC to 4 GHz, the HP 8765B also has SMA connectors and covers DC to 20 GHz, and the HP 33314C has 3.5 mm connectors and covers the DC to 26.5 GHz range. All the switches are available with voltage options covering any drive voltage between 4.5 volts up to 30 volts DC. Optional performance data is available as Option 890.

This family of switches was designed from the ground up for maximum dependability. The design goals included lowering cost and increasing the life. To do this, it was necessary to take full advantage of Hewlett-Packard's capabilities in machining and plating processes.

Long Life and Elegance

In electromechanical switches, to achieve long life, it was necessary to reduce or eliminate as many causes of failures as possible. Among the possible failure modes are structural failure of switching components, failure of the magnetic circuit, or degradation of microwave performance through debris collection or corrosion on internal microwave contacts.

The HP 8765 family of switches uses only four moving parts to accomplish the switching action. This means that there are fewer parts that can break, and fewer surfaces to generate frictional debris. The parts that do move are the rocker arm, which is the link between the magnetic circuit and the sliders, the 2 sliders, which move the edge-line jumper to form a transmission line between two of the three connectors at a time, and the return spring, which provides the linkage between the sliders.

The magnetic circuit was designed to work through a wide switching voltage range to give the user a more versatile and robust switch. The rocker arm, which is controlled by a coil and permanent magnet circuit, never comes in contact with the coils. This eliminates the possibility of impact damage and debris generation.

The sliders used to move the edge-line center conductor to the connectors to complete the microwave path are precision molded in Hewlett-Packard's plastic molding facility. Control over the dimensions of the finished molded part is critical to the reliability of this switch family. In particular, these sliders have guide channels in them which work with precisely ground and positioned dowel pins to precisely control the motion of the sliders in two ways. The first minimizes misalignment and torqueing of the sliders as they move, keeping

Driving the HP 8765A/B/C

them perpendicular to the plane of the RF contacts. The second dimension controlled is the distance the sliders can travel. This is very important, as it will determine the contact pressure between the jumpers and the RF contacts. The contact pressure between the jumper and RF contact is critical to the long life and repeatability of the switch. Too much pressure will damage both the jumper and contact, too little will not provide enough for a repeatable electrical contact. The RF contacts on the edge-line jumpers and the RF connector's center conductors are plated in Hewlett-Packard's plating facility to assure plating quality.

The spring, which links the two sliders, has been designed to provide consistent pull back pressure on the unselected jumper/slider combination. It is also designed to work in conjunction with the alignment dowel pins to prevent any unwanted torque on the sliders as they are moved.

Finally, the bodies of the switches and the moving parts have been selected and designed to provide sustained trouble free life. The surface finishes of the internal portions of the body which come into contact with the sliders, springs and rocker arm are machined to a smooth finish and then plated to minimize wear. This helps prolong life in two ways, first by reducing the degradation of materials by removing material and second by reducing the generation of wear debris. Wear debris can eventually find its way between the jumpers and RF contacts, increasing Insertion Loss and decreases switch repeatability. By controlling the amount of wear debris, and providing a wiping action of sufficient force between the jumpers and contacts, repeatability is maintained.

The HP 8765 Switch family is available with two methods for hooking up to the dc control circuitry. The standard switch comes with a ribbon cable terminated with a single in-line five position male connector with one pin removed. The user has the option of ordering solder terminals (Option 100) where they are required. (Figure 3)

The HP 8765 Switches have both sides of the switching solenoids available to the user. Typically, as is the case with the HP 8762 switches, the switching solenoids will have a common positive terminal or a common ground. By making both sides of each coil available, users can select the dc drive method that best suits their needs. The suggested methods are:

1) Common Negative Drive
2) Common Positive Drive
3) Polarity Reversal Drive

Regardless of which method is chosen for switching, two conditions will always apply: 1) the switch is positive latching and 2) since there are no dc current interrupts, the supply may be continuous or may be switched off after the 20 mSec switching time.

Common Negative Drive

With the common negative drive method, the two outside pins on the ribbon cable or the two outside terminals on the solder block are connected together to form a common negative or ground. Switching is then accomplished by applying the appropriate positive voltage to either of the inner pins or terminals. (Figure 1)

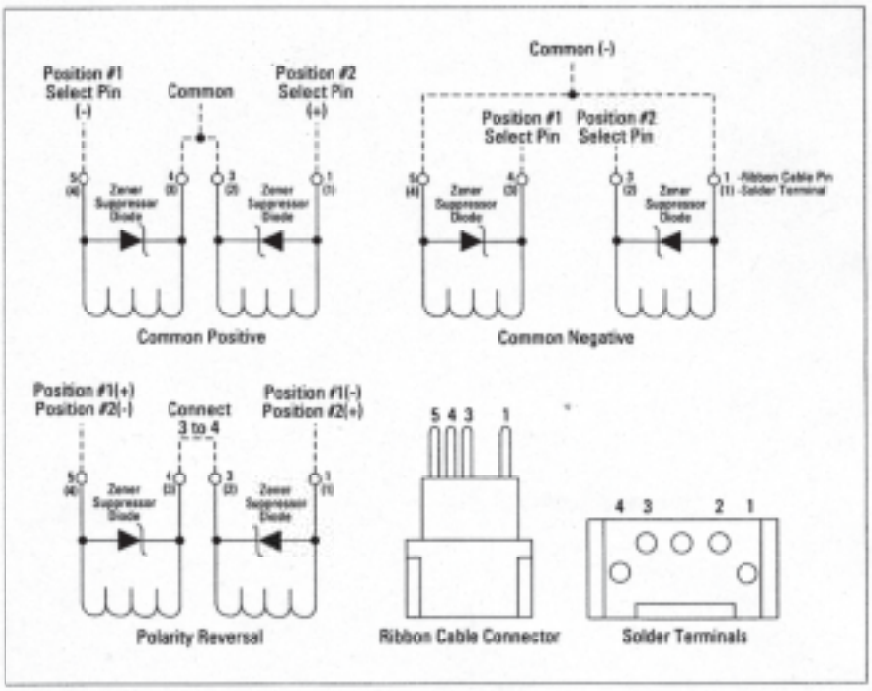


Figure 1.
DC Control Circuit Configurations.

Common Positive Drive

To drive the switch with a common positive arrangement, the two inner pins or terminals are tied together and then to a positive voltage. To affect switching, one of the two outer pins or terminals is brought to ground. (Figure 1)

Polarity Reversal Drive

To drive the switch using a polarity reversal scheme, the two inner pins or terminals are tied together. The switch will complete a circuit between the two RF contacts on the side of the switch to which the negative or ground potential has been connected. (Figure 1)

The single in-line male connector will accommodate any receptacle which mates to 0.64mm (0.025 inch) square pins on 2.54mm (0.100 inch) centers (for instance the DuPont Berg Mini-PV receptacle). Options 108 and 116 add an 8 inch or 16 inch extension cable. Option 100 specifies solder terminals in the place of the ribbon cable.

Easy HP-IB Programmability

The HP 8765 switch family can be easily used in ATE systems with HP-IB control using the HP 11713A Attenuator/Switch Driver. Connections for drive control are easily made by ordering the HP 11761A cable/adapter, which plugs into the HP 11713A and will connect up to four HP 8765A/B/C switches. Interconnecting between the HP 11713A and the HP 8765A/B/C switches with solder terminals (Option 100) is possible with the standard cables supplied with each HP 11713A. Each HP 8765 Option 024 continuously draws 120 mA, due to this constant draw of power, the HP 11713A can only accomodate five HP 8765's at a time.

Specifications

HP Model:	HP 8765A	HP 8765B	HP 8765C
Frequency range:	dc—4 GHz	dc—20 GHz	dc—26.5 GHz
Insertion loss (dB): (f is frequency in GHz)	0.2 + 0.025f	0.2 + 0.025f	0.25 + 0.027f
*Typical insertion loss:	0.2 @ 4 GHz	0.2 @ 4 GHz 0.5 @ 20 GHz	0.2 @ 4 GHz 0.5 @ 20 GHz 0.7 @ 26.5 GHz
Isolation (dB): (f is frequency in GHz)	120-2.25f	120-2.25f	120-2.6f
*Typical isolation:	120 @ 4 GHz	120 @ 4 GHz 90 @ 20 GHz	120 @ 4 GHz 90 @ 20 GHz 60 @ 26.5 GHz
SWR:	<1.2 dc - 4 GHz	<1.2 dc - 4 GHz <1.35 4 - 12.4 GHz <1.45 12.4 - 18 GHz <1.7 18 - 20 GHz	<1.25 dc - 4 GHz <1.45 4 - 18 GHz <1.7 18 - 26.5 GHz
Connectors:	SMA (f)	SMA (f)	3.5 mm(f)
Repeatability: (Up to 5,000,000 Cycles measured at 25° C, dc)	<0.03 dB	<0.03 dB	<0.03 dB

*Specification describe the instrument's warranted performance. Supplemental and typical characteristics are intended to provide information useful in applying the instrument by giving typical, but not warranted performance parameters.

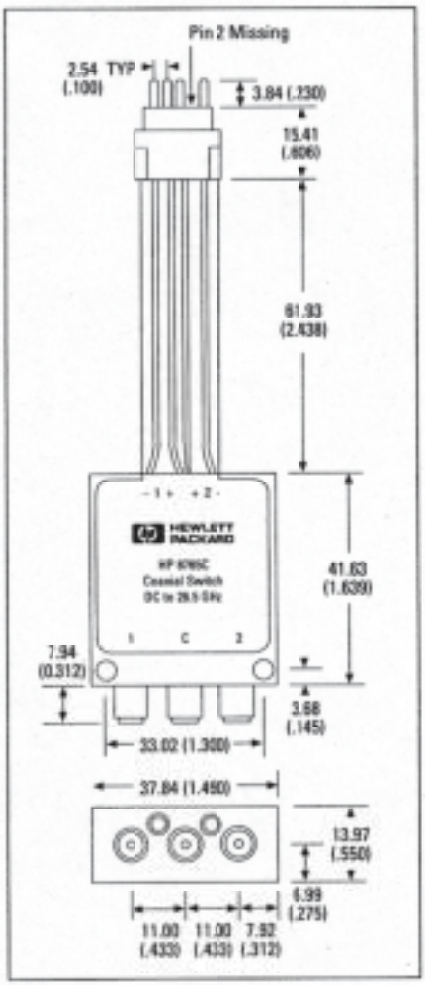


Figure 2. Standard unit part dimensions in millimeters and (inches).

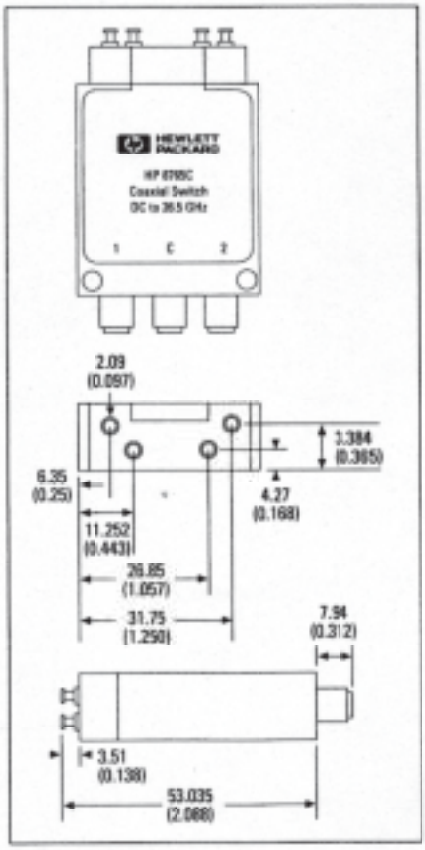


Figure 3. Option 100 with solder terminals part dimensions in millimeters and (inches).

General Operating Data

HEWLETT PACKARD

Maximum Power Rating: 2 watt average for switching with power applied.
100 watt peak, non-switching

Life: > 5,000,000 Cycles

Switching speed: 15msec maximum

Solenoid Electrical Specifications and Switching Voltage Options

Options	Voltage	Current	Impedance
005	5 (4.5—7) Vdc	385 mA @ 5 Vdc	13 ohm, 8 mH
010	10 (7—12) Vdc	300 mA @ 10 Vdc	33 ohm, 25 mH
015	15 (12-20) Vdc	200 mA @ 15 Vdc	75 ohm, 55 mH
024	24 (20—30) Vdc	120 mA @ 24 Vdc	200 ohm, 135 mH

HP Model	Calibration Frequencies
8765A	200 to 400 MHz every 200 MHz
8765B	200 to 18000 MHz every 200 MHz
8765C	1500 to 26500 MHz every 250 MHz

Environmental

Operating Temperature:
-25° to 75° C

Storage Temperature:
-55°to 85° C

Temperature Cycling:
-55° to 85°C, 10 cycles per MIL-STD-883 method 1010

Vibration:
Operating: 7 g's; 5-2000 Hz @ 0.25" p-p
Survival: 20 g's; 20-2000 Hz @ 0.06" p-p 4 min/cycle, 4 cycles/ per axis MIL-STD-883 method 2007
Random: Survival: 2.41 g(rms) 10 min/axis

Shock:
Half Sine: 500 g's @ 0.5 mS, 3 drops/direction, 18 total per MIL-STD-883 method 2002.1
Operating: 50 g's @ 6 mS, 6 directions

Moisture Resistance: 65°C, 95% RH, 10 days per MIL-STD-883 method 1004

Altitude Storage: 50,000 ft. (15,240 meters) per MIL-STD-883 method 1001, for > 1 hour

RFI: per MIL-STD-461C, RE02, part 4

Electrostatic Discharge:
25 kV max

Abuse: 2W, CW, 1 kW peak pulse (10 μs), 2 minute duration

Operating Life:
>5,000,000 cycles

Ordering Information

Specify switching voltage option (005, 010, 015, or 024).

Specify flexible cable extensions if needed:
Option 108: 8 inch (20.3 cm)
Option 116: 16 inch (40.6 cm)

Option 100 solder terminals are available in place of ribbon drive cable.

HP 11761A Cable/Adapter: this 5-foot cable connects directly between the HP 11713A Attenuator/ Switch Driver and the ribbon cable of up to four HP 8765A/B/C switches.

Option 890 SWR and insertion loss data measured with an automatic network analyzer with very small uncertainties; directly traceable to NIST standards.

For more information, call your local HP sales office listed in the telephone directory white pages. Ask for the Components Department, or write to Hewlett-Packard:

United States
P.O. Box 10301
Palo Alto, CA 94303-0890
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29-21, Takaido-Higashi 3-chome
Suginami-ku, Tokyo 168

Elsewhere in the World
Hewlett-Packard Company
Intercontinental Headquarters
3495 Deer Creek Road
Palo Alto, CA 94304-1393 U.S.A.

Data Subject to Change
May 1989

Printed in U.S.A.
5953-2351

CERTIFICATION

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility, and to the calibration facilities of other International Standards Organization members.

WARRANTY

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of two year from the date of shipment. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by HP. Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

HP warrants that its software and firmware designated by HP for use with an instrument will execute its programming instructions when properly installed on that instrument. HP does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error-free.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HP SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTIBILITY AND FITNESS FOR A PARTICULAR PURPOSE.

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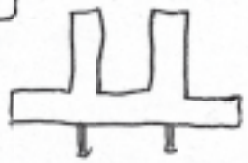
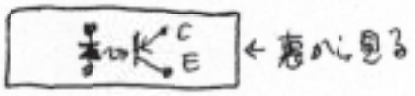
Berks, RG11 5AR

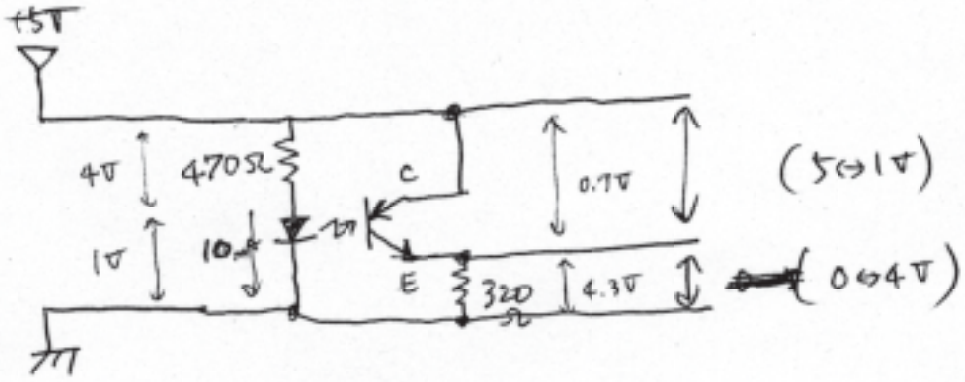
AFRICA, ASIA, CENTRAL AND SOUTH AMERICA
Hewlett-Packard Intercontinental
3200 Hillview Avenue
Palo Alto, CA 94304

フォトインタラプターの使い方



TP507A





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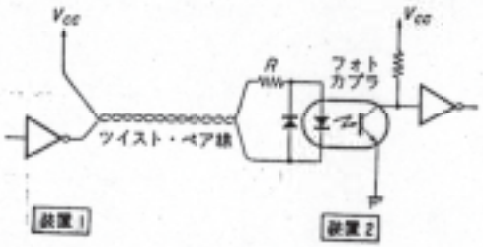
フォト・センサは発光，受光間の距離，条件によって定常光を用いるか，あるいは変調光を用いるかを決めればOKです．

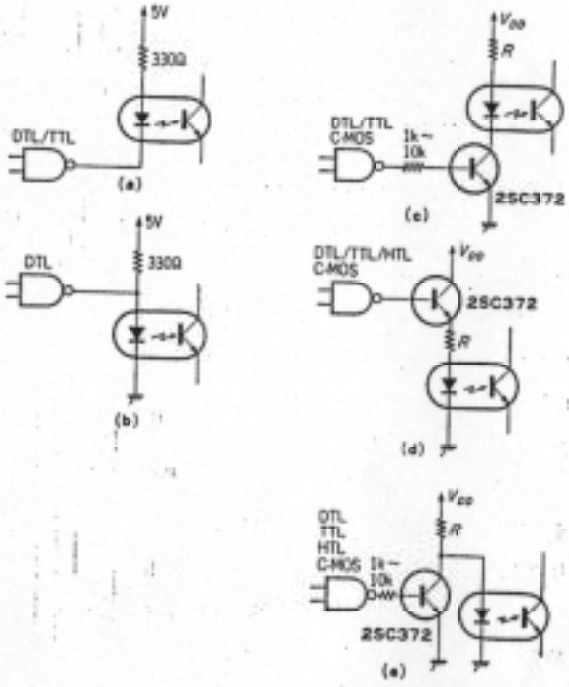
◎フォト・カプラによるインターフェース回路

フォト・カプラとして最も有効で，かつ多く用いられる個所として，二つの装置のインターフェースがあります．装置と装置，たとえばコンピュータ・システムと端末機器といった装置を結合する場合，接地ループやそれに関連する誘導，雑音などの問題で誤動作を起こすことがあります．

〈図5-78　フォト・カプラによる装置間の接続〉



〈図5-79　フォト・カプラの駆動回路〉



このような影響を除くために，従来，リード・リレーなどを用いていましたが，処理スピードが遅いという欠点がありました．そこで，図5-78のようにフォト・カプラを用いることにより，両装置を電気的に絶縁することができ，接地ループなどの問題を解決することができます．

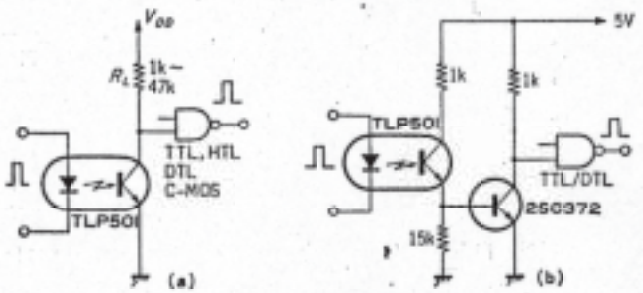
このようにフォト・カプラは電気的分離に使われますが，その駆動方法にはいろいろな方法があります．図5-79はいろいろなディジタルICによるフォト・カプラの駆動回路を示します．

DTLやTTLで駆動するときはそのまま接続が可能ですが，C-MOSで直接駆動するのはちょっと苦しくなります．したがって，同図(c)(d)(e)のようにトランジスタを用いるのが無難といえます．図において，電流制限抵抗 R はLEDに流す電流値に応じて選定します．

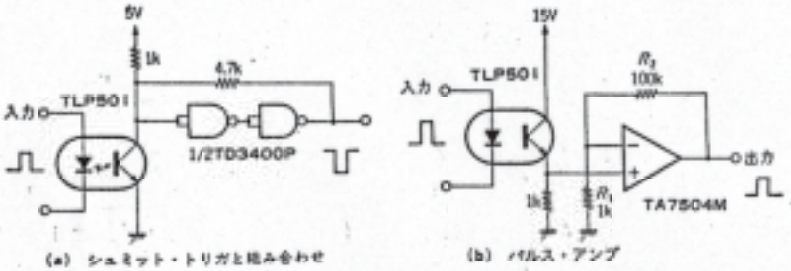
次に，フォト・トランジスタ側の回路を図5-80に示します．TLP501などは変換効率が10%以上ですからLED側の駆動電流を20～30mA流せばTTLやDTLを直接ドライブできますが，LED側電流が小さいときは，同図(b)のようにトランジスタで電流増幅を行なった後，駆動する必要があります．

また，フォト・カプラの応答時間は数 μS となりますが，それを整形するには，図5-81(a)のようにシュミット回路を構成すると有効です．同図(b)はOPアンプを用いた回路で，LED側の入力が小さい時に有効です．OPアンプの利得は $(R_1+R_2)/R_1$ で与えられますから，適当に選ぶことにより，入力がかなり小さくても充分といえます．

〈図5-80　ディジタルICとのインターフェース〉



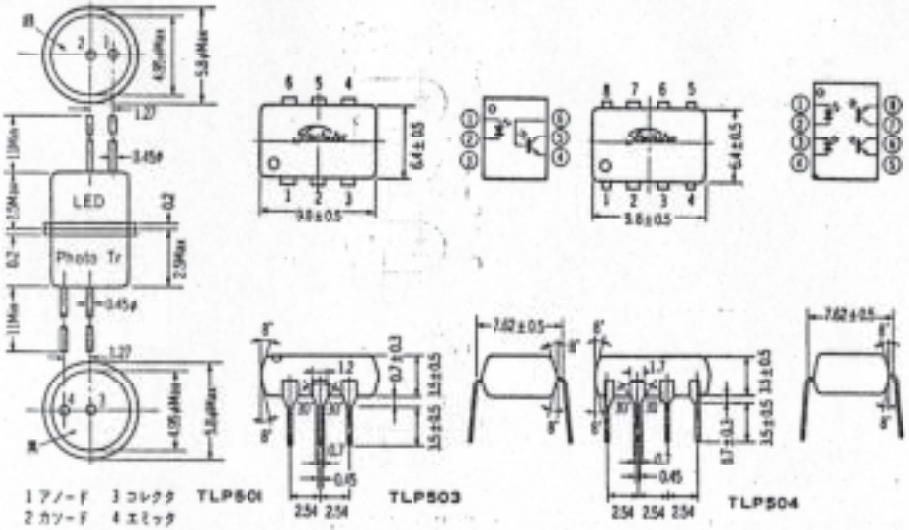
〈図5-81　入力回路〉



◎フォト・カプラによる論理回路

フォト・カプラのおもしろい応用として，直接論理回路を組むことができることです．図5-82はその回路で，たとえば，図(a)の回路では，二つの入力に"1"が入ったときだけ出力が

〈図5-28　フォト・カプラの外形（単位mm）〉

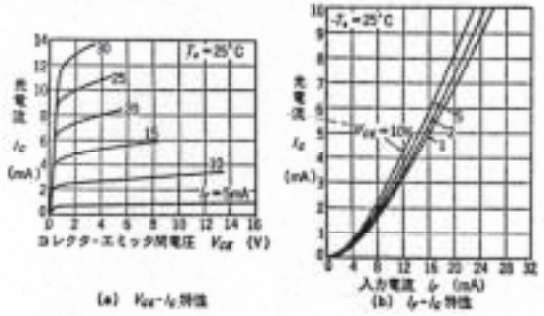


れぞれ DIP の6ピン，8ピンに封入されています．したがって，TLP503，504はディジタルICと組み合わせて使うとき便利となります．

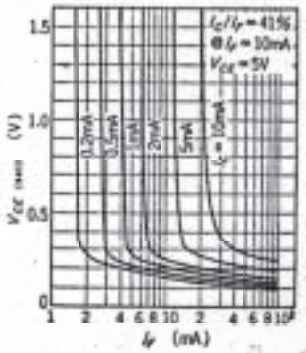
フォト・カプラの重要なパラメータとして信号の伝達効率がありますが，LEDの順電流 I_F に対してフォト・トランジスタのコレクタ電流 I_C の比を取り，I_C/I_F を変換効率と呼びます．表5-3の特性では標準30%ですから，I_F=10mA のとき I_C= 3 mA ということになります．

図5-29は変換特性を表わしたもので，(a)はフォト・トランジスタの V_{CE}–I_C 特性で，I_F をパ

〈図5-29　フォト・カプラの伝達特性（TLP501）〉



〈図5-30　I_F–$V_{CE(sat)}$ 特性（TLP503）〉



ラメータにしたものです．(b)は変換特性を示しますが，小電流で使用するより I_F>10mA で使用するほうが効率がよいといえます．

また，トランジスタが飽和状態にあるとき，そのコレクタ・エミッタ間の残り電圧 $V_{CE(sat)}$ は普通 0.2～0.4V 程度ですが，図5-30に I_C をパラメータにした I_F と $V_{CE(sat)}$ の関係を示

〈表5-3　フォト・カプラの電気的特性例（T_a=25°C）〉

最大定格⇨

	項目	記号	定格 TLP501	定格 TLP503,504	単位
LED	順電流（DC）	I_F	60	60	mA
	順電流（Pulse）*	I_{FP}	1	1	A
	逆方向電圧	V_R	6	6	V
	許容損失	P_C	100	100	mW
	低減率	ΔP_D/°C	−	1.3	mW/°C
DETECTOR	コレクタ・ベース間電圧	V_{CBO}	−	50	V
	コレクタ・エミッタ間電圧	V_{CEO}	45	20	V
	エミッタ・コレクタ間電圧	V_{ECO}	6	5	V
	エミッタ・ベース間電圧	V_{EBO}	−	5	V
	許容損失	P_C	100	150	mW
	低減率	ΔP_C/°C	−	2	mW/°C
	動作温度	T_{opr}	−30～100	−30～100	°C
	保存温度	T_{stg}	−50～125	−55～125	°C
	許容損失（503）	P_T	−	200	mW
	低減率（503）	ΔP_T/°C	−	2.6	mW/°C
	許容損失（504）	P_T	−	400	mW
	低減率（504）	ΔP_T/°C	−	5.3	mW/°C

◊電気的特性

	項目	記号	条件	TLP501 MIN	TLP501 TYP	TLP501 MAX	TLP503,504 MIN	TLP503,504 TYP	TLP503,504 MAX	単位
LED	順方向電圧	V_F	I_F=10mA	−	1.10	1.25	−	1.10	1.25	V
	逆電流	I_R	V_R=5 V	−	−	1.0	−	−	1.0	μA
	静電容量	C	V=0，f=1 MHz	−	50	−	−	50	−	pF
DETECTOR	コレクタ・エミッタ間電圧	BV_{CEO}	I_C=0.5mA	45	−	−	20	−	−	V
	コレクタ・ベース間電圧	BV_{CBO}	I_C=0.1mA	−	−	−	50	−	−	V
	エミッタ・コレクタ間電圧	BV_{ECO}	I_E=0.1mA	6	−	−	5	−	−	V
	暗電流	I_{CEO}	I_F=0，V_{CE}=10V，TLP501は30V	−	−	500	−	−	100	nA
	静電容量	C	V=0，f=1 MHz	−	7	−	−	10	−	pF
COUPLED	変換効率	I_C/I_F	I_F=10mA，V_{CE}=5 V，V=0	10	30	−	10	30	−	%
	入出力間静電容量	C_S	f=1MHz，R.H.=40～60%	−	2	−	−	2	−	pF
	絶縁抵抗	R_S	V=1000V	−	10^{11}	−	−	10^{11}	−	Ω
	絶縁耐圧	BV_S	DC，1 minute	1000	−	−	2000	−	−	V
	立ち上がり，立ち下がり時間	t_r，t_f	V_{CC}=10V，R_L=100Ω，I_C=1 mA	−	5	−	−	5	−	μS