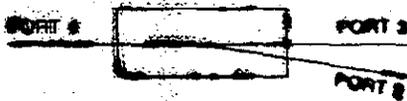


FUSED COUPLERS

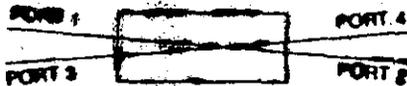
APC-3 and APC-4 are the three- and four-port members of the Ætna family of passive fiber optic couplers. They offer versatility and high performance, are rugged and reliable, and come in three standard coupling ratios—50/50 (Type A), 90/10 (Type B) and 99/1 (Type C). Other ratios available on special order.

Use them as bi-directional couplers or as signal taps, power level monitors, beam splitters or combiners. A few of the many applications for these devices are local area networks . . . automatic gain control . . . process control applications . . . fault detection . . . and multi-terminal fiber optic data buses.

MODEL APC-3



MODEL APC-4



Principle of operation: Light entering any port is coupled to the port or ports at the opposite end of the device. The degree of coupling is easily variable, but becomes fixed at time of fabrication.

Standard Features

- Low in price (See price sheet)
- Low loss (Typical = 0.5 dB, Maximum = 1.0 dB)
- Low optical crosstalk (Typical = 40 dB)
- Coupling ratios (Typ) of 50/50, 90/10, 99/1
- Wavelength independence
- Small in size (overall length only 102 mm)
- Light in weight (30 grams)
- Four choices of fiber:

	Core/Clad (µm)
Graded index	50/125
Graded index	100/140
Step index	100/140
Step index	200/250

OPTICAL SPECIFICATIONS APC-4

INTER-PORT COUPLING MATRICES (dB)

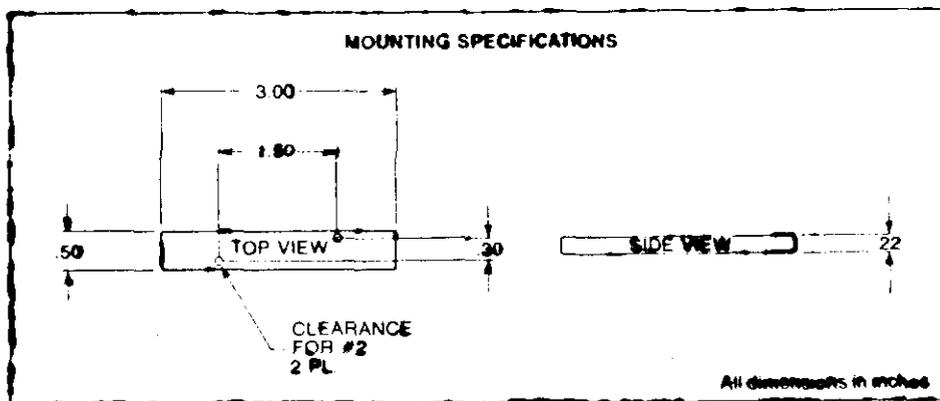
50/50 coupling ratio (Type A)		90/10 coupling ratio (Type B)		99/1 coupling ratio (Type C)						
		Output Port		Output Port						
		1	2	3	4					
Input Port	1	40	3.5	40	3.5	1	40	0.5	40	20.5
	2	3.5	40	3.5	40	2	0.5	40	20.5	40
	3	40	3.5	40	3.5	3 <td>40</td> <td>20.5</td> <td>40</td> <td>0.5</td>	40	20.5	40	0.5
	4	3.5	40	3.5	40	4 <td>20.5</td> <td>40</td> <td>0.5</td> <td>40</td>	20.5	40	0.5	40

Typical excess loss is .5 dB; 1.0 dB is max.

Directivity (crosstalk) for these couplers is typically 40 dB.

Measurements are based on the index matching of appropriate ports.

Coupling ratios of Type A couplers are accurate to ± 1.0 dB.



PHYSICAL/ENVIRONMENTAL SPECIFICATIONS

Length: 102 mm

Width: 13 mm

Height: 10 mm

Weight: 30 grams

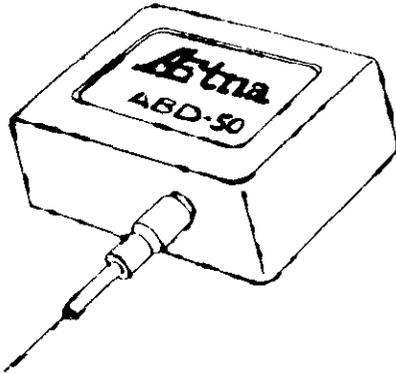
Temperature Range: $-40^{\circ}\text{C} < T < 65^{\circ}\text{C}$

All fused couplers are supplied with 50cm fiber pigtails in reinforced jackets.

SPECIAL ORDERS

Ask us about fused couplers customized to your specifications:

- Non-standard coupling ratios
- Couplers with 50 dB directivity
- Special packaging
- Asymmetric couplers (i.e., non-reciprocal power splitting)
- We'll also evaluate your fiber for coupler fabrication.



ACTIVE BI-DIRECTIONAL COUPLER

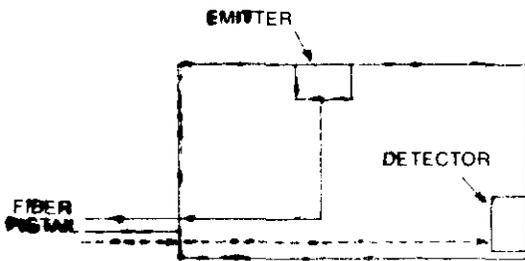
There are four reasons why Ætna's active bi-directional coupler (ABD-50) is the perfect building block for full duplex communications systems:

1. It comes complete with premounted source and detector, saving you the time, expense and aggravation of splicing or connecting these to normally separate components. An important secondary benefit: By eliminating the need for lossy connectors or splices, the ABD-50 coupler permits higher coupled power. This translates into improved system performance.
2. It simplifies system design and cuts fiber costs in half.
3. It enables simultaneous bi-directional transmission on a single fiber.
4. Above all, this active coupler costs significantly less than a typical passive coupler.

The ABD-50 is a small component, light in weight, and fabricated in one piece for ruggedness. It is efficient across a wide range of temperatures.

Ætna's active bi-directional coupler can be used in CATV systems, local area networks, point to point links, computer networks—virtually any terminal, device or system with a transmit/receive requirement.

Our ABD-50 coupler is offered with a standard 50/50 coupling ratio . . . but it can be special ordered with any coupling ratio you choose. Call us today for more information.

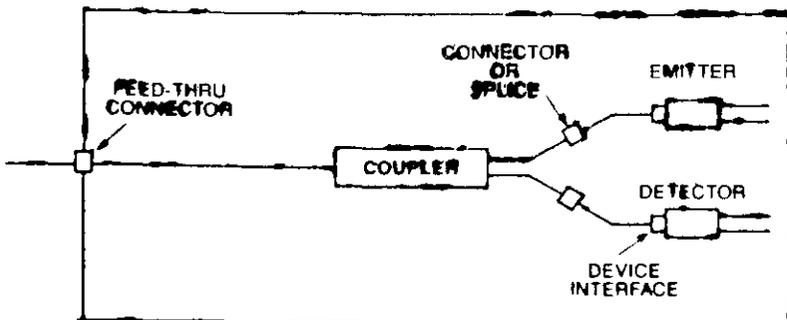


	Core/Clad (μm)	N.A.
Standard Fibers:	50/125	0.2
	100/140	0.3

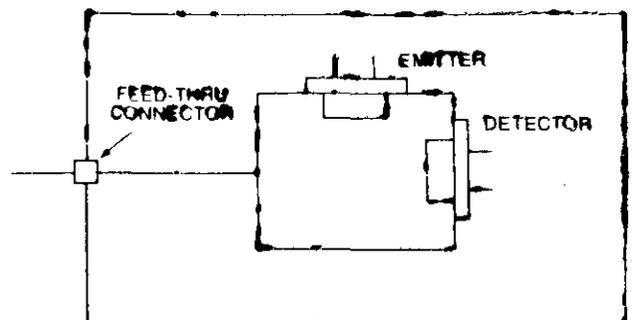
Other fibers available on special order.

SEE HOW EASILY THIS ACTIVE COUPLER BY ÆTNA CAN SIMPLIFY YOUR DESIGN AND INSTALLATION

Transceiver designed with a typical passive coupler:



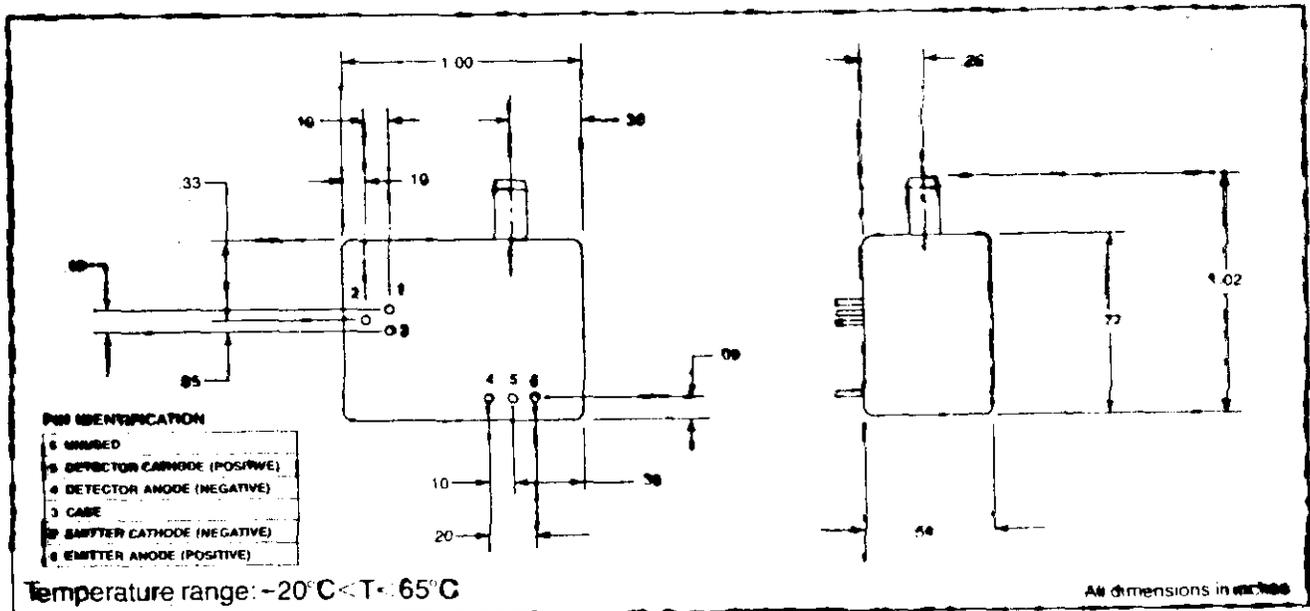
Transceiver designed with Ætna's Model-ABD Active Coupler:



OPTICAL SPECIFICATIONS

	minimum	typical
Optical power coupled into fiber (100 mA drive current)	28 μW	45 μW
Coupler responsivity	0.2 A/W	0.25 A/W
Crosstalk	-	25 dB

PHYSICAL/ENVIRONMENTAL SPECIFICATIONS



STANDARD EMITTER

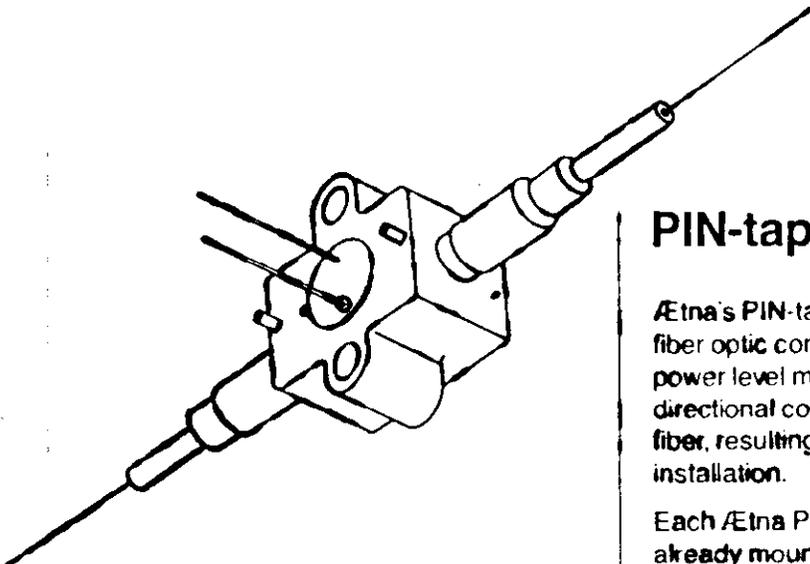
Peak wavelength:	820 nm
Response time:	3 ns
Spectral half-line width	35 nm
Maximum forward bias current (Continuous)	200 mA

Typical measurements at 25°C

STANDARD DETECTOR

Responsivity @ 900 nm	0.55 A/W
Response time @ 50 volts	4.6 ns
Dark current @ 50 volts	35 nA

Ætna's active couplers are supplied with 1-meter fiber pigtailed.



PIN-tap coupler

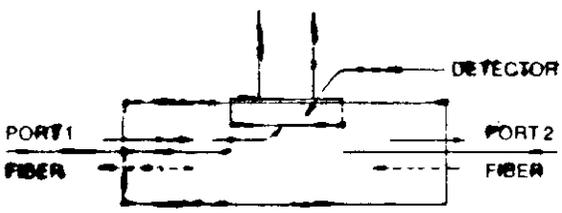
Ætina's PIN-tap coupler is a multi-purpose, high-quality, low-cost fiber optic component. It can be used as an optical signal tap, power level monitor or bi-directional coupler. Used as a bi-directional coupler, it enables two-way transmission over a single fiber, resulting in simple, cost-effective system design and installation.

Each Ætina PIN-tap coupler comes with a high speed detector already mounted, thus eliminating the signal loss and cost one usually encounters when providing a connection to a fiber pigtail. PIN-tap couplers are lightweight yet rugged, and perform efficiently over a wide range of temperatures.

Standard splitting ratios are 90/10 (90% thru/10% tap), 50/50 and 10/90; other splitting ratios can be ordered.

Ætina's PIN-tap couplers are the perfect choice for Local Area Networks, CATV, point-to-point links, high-performance computer networks and similar applications. And they are available now.

Here's how the Ætina PIN-tap coupler works



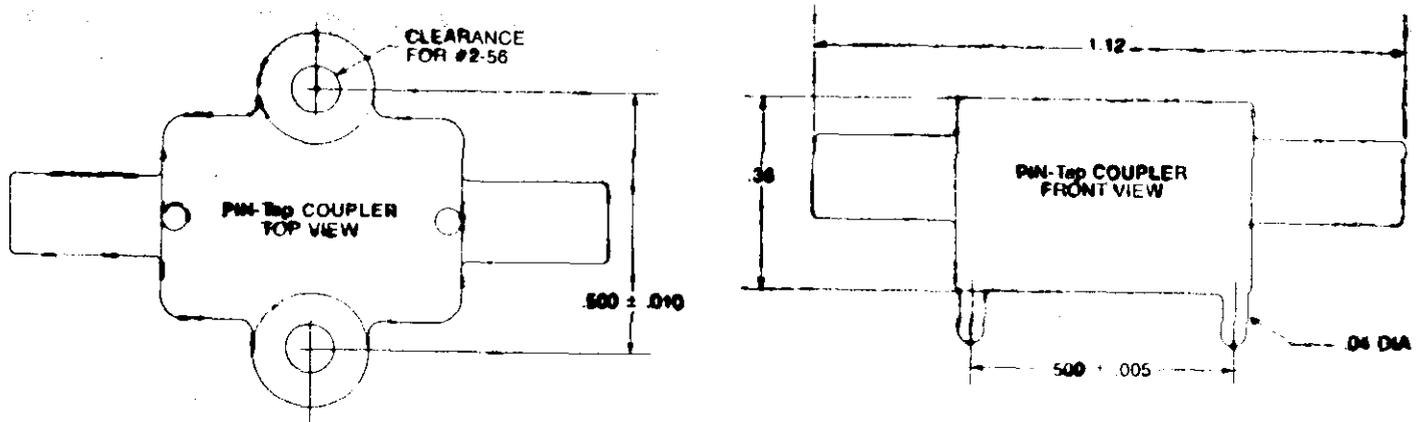
Using, as an example, a coupler with a 50/50 splitting ratio (APT-50), half the light from port 1 is directed to the PIN detector; the remaining signal is coupled into the fiber at port 2. In the reverse direction, half the light from port 2 is coupled into the fiber at port 1, while the other half radiates out of the coupler.

Standard PIN-Tap Coupler

Splitting ratios: 90/10 (APT-10), 50/50 (APT-50), 10/90 (APT-90)

	Core/Clad (μm)	N.A.
Fiber:	50/125	0.2
	100/140	0.3
	200/250	0.2
Detector:	T0-18, T0-46 and T0-52 style packages	

PHYSICAL/MOUNTING SPECIFICATIONS



All dimensions in inches

OPTICAL SPECIFICATIONS

Standard splitting ratios:	90/10, 50/50, 10/90
Excess loss:	1 dB maximum
Isolation (for typical 50/50 split)	-20 dB

ENVIRONMENTAL SPECIFICATIONS

Temperature range $-20^{\circ}\text{C} < T < 65^{\circ}\text{C}$

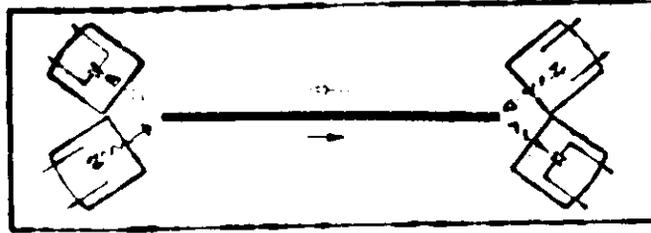
STANDARD DETECTOR

Responsivity	.5 A/W
Rise time	< 2 ns
Forward bias voltage	5 volts

SPECIAL ORDERS

Ask us about PIN-tap couplers customized to your specifications:

- Splitting ratio
- Non-standard fiber type
- Non-standard detector



FIBER OPTICS BIDIRECTIONAL COUPLER

FOBC-850

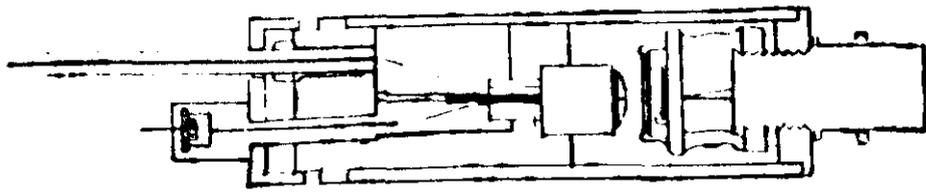
The bidirectional coupler/monitor transmits and receives optical signals on the same single fiber while providing a monitor signal. The unit consists of a light source (LED or laser), a detector, and a signal transmitting and receiving fiber.

FEATURES

- Transmitting and receiving optical signal in the same fiber.
- Efficient coupling of light
- Provides monitoring signals propagating in either direction within the fiber.
- Built-in source coupler
- Built-in receiver
- Wide spectral range
 - Light source: standard at 890 nm or customer's optional wavelength
 - Optical components: 400-2500 nm
 - Detector: 400-1050 nm or customer's optional wavelength
- Monolithic design
- Compact and lightweight
- Easy to couple with other devices

APPLICATIONS

- Broadband multichannel communication systems.
- Connecting two remote terminals to a computer system
- Specialized fiber optics systems
- Measurement of source and fiber characteristics
- Fiber optics source
- Fiber optics receiver
- Monitoring signal from both directions

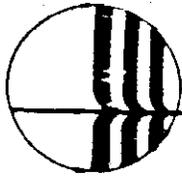


actual size

SPECIFICATIONS

OPTICAL OUTPUT LEVEL	Power level, each direction, relative to input	-4.0 dB MIN
FIBER TYPE	Compatible with any 125 μm ($\pm 5 \mu\text{m}$) O.D. glass fibers having 62.5 μm core diameter. Standard units have been designed for visible to infrared (400-2500 nm) operation. The source has power cable with connector and the detector has BNC connector. Other operational wavelengths and coupling connectors can be specified at customer's option.	
MONITOR CHARACTERISTICS		
	Sensitivity at 860 \pm 50 nm (output current/optical input power in either cable):	2.5 $\mu\text{a}/\mu\text{w}$ MIN
	Mode sensitivity (variation in monitor current with dominant propagation mode in fiber):	$\pm 5\%$ MAX
	Response time (rise or fall time, 50 ohm): optional fast detector:	1 μsec. MAX 10 nsec. MAX
	Noise equivalent power, input fiber	8×10^{-13} w/ $\sqrt{\text{Hz}}$
	Electrical output connector	BNC
TEMPERATURE	Operating: Storage:	0° C to 80° C -50° C to 120° C
WEIGHT		60 gm
DIMENSIONS		1.91 cm O.D. X 12 cm long

k KAPTRON, Inc.
580 College Avenue
Palo Alto, CA 94306 (415) 493-8088



OPTICAL
COMMUNICATION
SYSTEMS

NEC

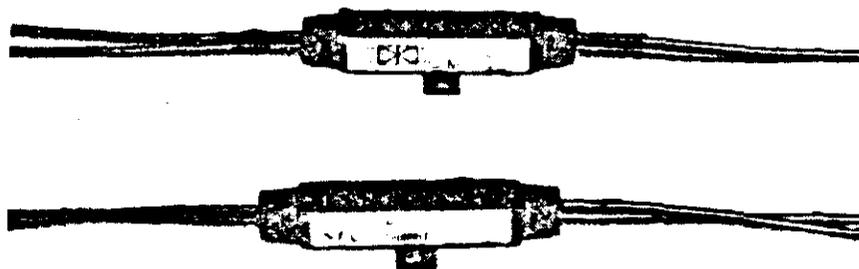
Nippon Electric Co., Ltd.

LC-4002

OPTICAL COUPLER

The LC-4002 Optical coupler is high performance coupler suitable for fiber optics. It's useful for optical branching and optical coupling in optical fiber transmission systems.

This device is also available for measuring optical fibers and experimental uses.



FEATURES

- o Small size
- o High performance
- o **High reliability**
- o Light weight

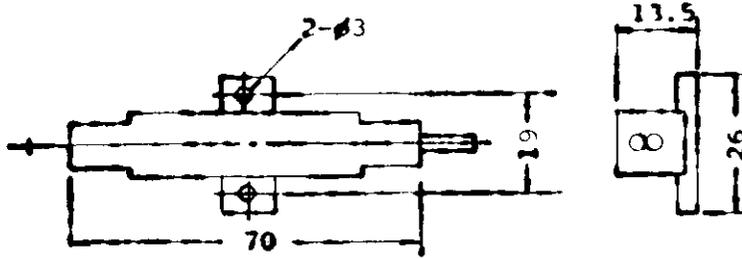
PERFORMANCE

- o Temperature $-20^{\circ}\text{C} \sim +70^{\circ}\text{C}$
- o Insertion loss $< 1 \text{ dB}^*$ (LC-4002-01)
- o Branching ratio^{**} (Nominal)
1 : 0.9, 1 : 10, 1 : 100

* Light source is LD and fiber is 60 μm in core diam. 0.2 in N. A.

** Wavelength is 0.83 μm .

DIMENSIONS



unit: mm

SPECIFICATIONS

ITEM	LC-4002 -01-□	LC-4002 -02-□	LC-4002 -□□□-A	LC-4002 -□□□-B	LC-4002 -□□□-C
Port number	3	4	—	—	—
Dividing ratio	—	—	1 : 0.9	1 : 10	1 : 100

OPTIONS

- LC-1003 Optical connector for each tail end.
- Anti-reflection terminal for a tail of LC-4002-02-□.

APPLICATIONS

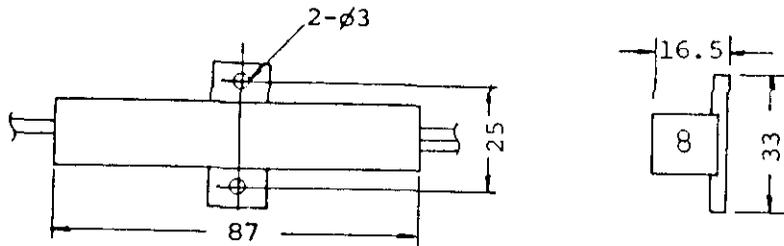
- Data bus system.
- CATV
- Fiber measuring equipment
(Power monitoring, Fault locator etc)
- Experimental use
(Light multiplexer, Insertion of optical noise etc)

(Note) Information contained in this catalog is subject to change without previous notice.

NEC Nippon Electric Co., Ltd.

NEC Building
33-1, Shimo-Ogino, Maebashi
Tokyo 108, Japan
Tel: Tokyo 456-1111
Cable Address: NIPPONPHONE TOKYO
Telex Address: NECVOR J22000

DIMENSIONS



Unit: mm

SPECIFICATIONS

Light source	LED
Wavelength	800 nm, 880 nm
Fiber	100 um core diam. Step index

OPTIONS

- o LC-1003 Optical connector for each tail end.

APPLICATIONS

- o Bi-directional optical WDM systems.

(Note) Information contained in this catalog is subject to change without previous notice.

NEC Nippon Electric Co., Ltd.

NEC Building
33-1, Shiba Gochome, Minato-ku
Tokyo 108 Japan
Tel. Tokyo 454-1111
Cable Address "MICROPHONE TOKYO"
Telex Address NECTOK J22686

ML-80-138

55.8 ①

Constar has designed and developed three and four port and multi port star couplers with a wide range of coupling coefficients. Low cost and reliability are achieved through refinement of the fused bi-conical taper technique.

Constar couplers are designed for use with step and graded-index fibers. They are engineered to function in industrial environments. The devices are enclosed in a sturdy housing with 50 cm cabled fiber leads for splicing into fiber optic systems.

Bidirectional Couplers

Bidirectional couplers are supplied using the following fiber types:

Fiber Type	Core Size	
	(μm)	O.D. (μm)
Graded Index	50 & 62.5	125
Step Index (all glass)	100	140

Constar fiber optic couplers are passive devices and are essentially wavelength independent. The TC4 is a coupler with 4 equivalent ports. Light entering any port is coupled to both ports on the opposite end of the device. The TC3 is a three port coupler identical to the TC4 except that one port is internally terminated.

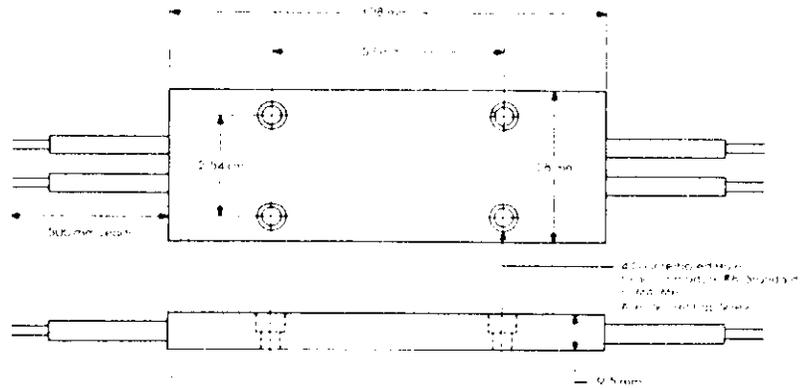
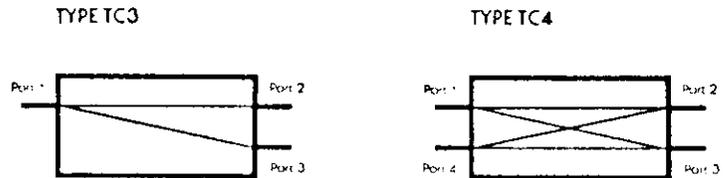
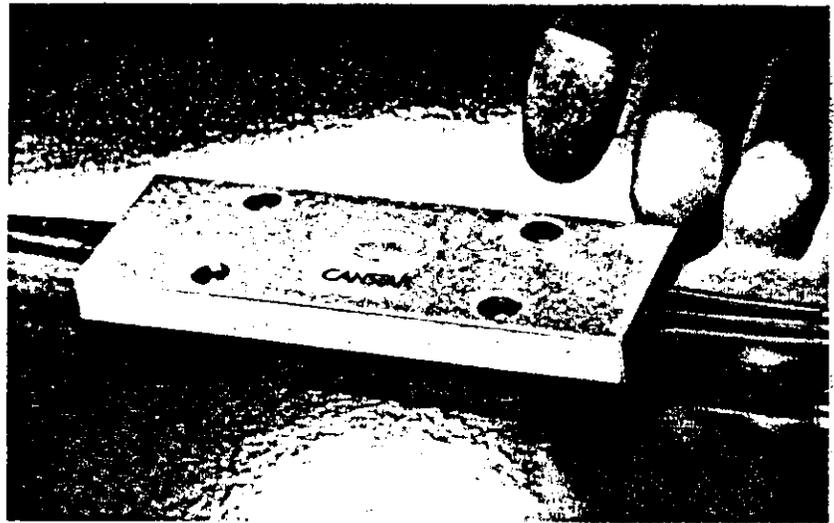
Star Couplers

Star couplers are designed and fabricated to meet customers' special requirements. Customer selected fiber can be analyzed for possible use in fabrication of couplers.

TCS star couplers have been provided for up to 200 ports. Both transmission and reflective types are available.

Typical star coupler specification:

- 2 ports input by 4 ports output
- Step index fiber (100 μm core / 140 O.D.)
- less than 1.5 dB total excess loss
- output uniformity to within 1 dB



Fiber Optic Cables

Typical Fibers	Type	Core Dia. mm	Cladding dia. mm	Loss at 850 nm	Bandwidth MHz/km	N/A
1 & 2	GI	.05	.125	< 4 dB/km	300	20
	SI	.10	.140	< 7 dB/km	100	30
4-48	GI	.05	.125	< 3.5 dB/km	90-800	20

A variety of cables and connectors are available to meet every application.

Bidirectional Couplers

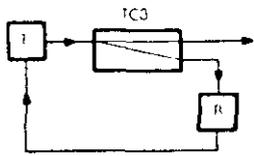
Performance Characteristics TC3-TC4

input port	output port	Model			NOMINAL COUPLING
		A	B	C	
1	2	75	60	40	%
		1.2	2.2	4	dB
	3	5	20	40	%
		13	7	4	dB
2	4	.01	.01	.01	% MAX
		40	40	40	dB MIN
	1	75	60	40	%
		1.2	2.2	4	dB
3		.01	.01	.01	% MAX
		40	40	40	dB MIN
	4	5	20	40	%
		13	7	4	dB

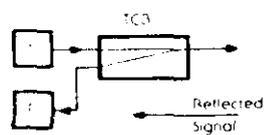
Directivity performance is measured at the adjacent port with the output port terminated using index matching fluid.
 Directivity of greater than 50 dB can be supplied on special order.
 Excess loss is the difference between the input and the sum of the outputs

input port	output port	Model			NOMINAL COUPLING
		A	B	C	
3	1	5	20	40	%
		13	7	4	dB
	2	.01	.01	.01	% MAX
		40	40	40	dB MIN
4	4	75	60	40	%
		1.2	2.2	4	dB
	1	.01	.01	.01	% MAX
		40	40	40	dB MIN
1	2	5	20	40	%
		13	7	4	dB
	3	75	60	40	%
		1.2	2.2	4	dB
Excess Loss		20	20	20	% MAX
		1	1	1	dB MAX
		0.5	0.5	0.5	dB TYP
Output port ratios		15:1	3:1	1:1	Main Port Secondary Port

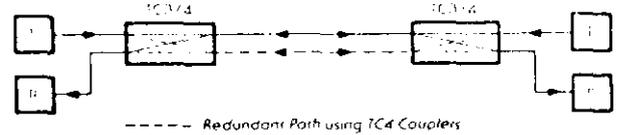
Applications



Feedback Loop

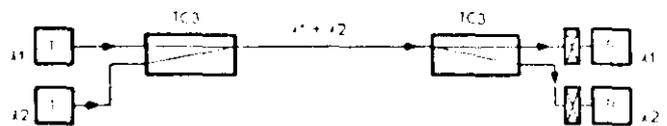
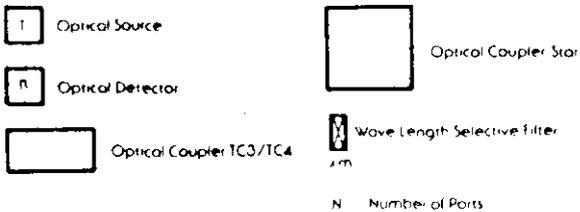


Reflectometer



Full Duplex and Bidirectional Transmission on a Single Fiber or Separate Fibers for a Protected Route.

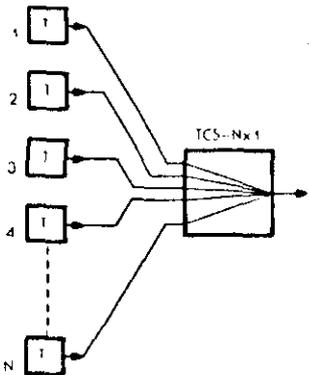
Legend



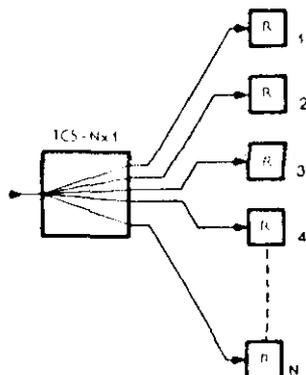
Wave Length Division Multiplexer

Star Couplers

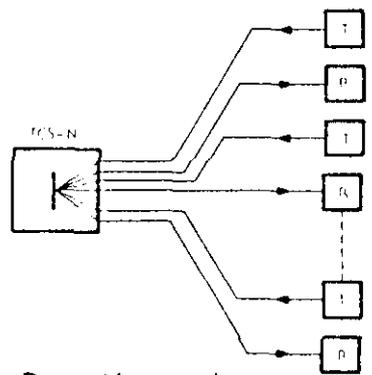
Applications



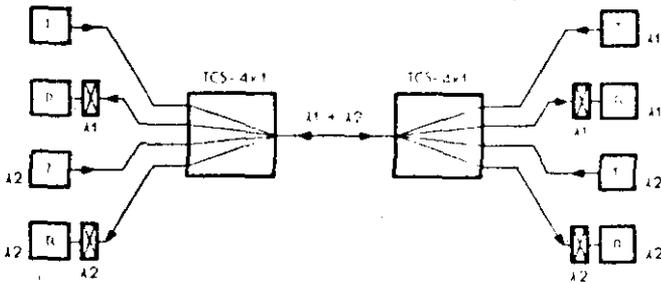
Data Collection



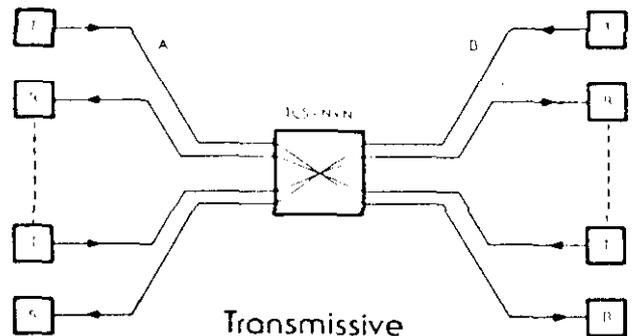
Data Distribution



Reflective Star Data Network
where all Ports are Equal



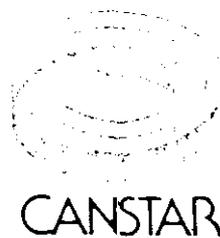
Bidirectional Wave Length Division
Multiplexing on a Single Fiber



Transmissive
Star Network:
Transmission is $A \rightarrow B$ and $B \rightarrow A$,
but not $A \rightarrow A$ or $B \rightarrow B$

Canstar Communications is a division of Canada Wire and Cable Limited, a wholly owned subsidiary of Noranda Limited one of Canada's largest resource and manufacturing companies, with 1981 assets exceeding 3 billion dollars. With marketing headquarters in Toronto Canstar provides a complete fiber optic systems capability for telecommunications, industrial control, computer and CATV applications.

Full customer support is provided in systems design, implementation and training including electronics, opto electronics, test equipment and cables. Canstar's extensive field experience under extremes of climatic conditions assures you of a proven design, manufacturing and splicing expertise.



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A division of Canada Wire and Cable Limited