Manual

Ident-M System V

Microwave Identification
System

$C \epsilon$

PEPPERL+FUCHS

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1 Declaration of Conformity

The devices of the microwave identification system were developed and manufactured in accordance with the European standards and directives.

The corresponding declaration of conformity can be requested from the manufacturer.

Note

Pepperl+Fuchs GmbH, the manufacturer of the product in D-68301 Mannheim, has a certificated quality assurance system in accordance with ISO 9001.

CE   ISO**9001**

2 General Information

2.1 Symbols Used

This symbol warns of possible danger.
Failure to heed this warning can lead to personal injury or death and/or damage to or destruction of equipment.

Warning

This symbol warns the user of a possible failure.
If the instruction given in this warning is not heeded, the device and any plant or systems connected to it could develop a fault or even fail completely.

Attention

This symbol alerts the user of an important hint.

Note

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2.2 Approval Certificate

BUNDESAMT FÜR ZULASSUNGEN IN DER TELEKOMMUNIKATION

ZULASSUNGSURKUNDE

Zulassungsnummer: A116624F

Zus. Kennzeichen: GL

Objektbezeichnung: Ident-M

Zulassungsinhaber: Pepperl + Fuchs GmbH
Königsberger Allee 85-87

D-68307 Mannheim

Zulassungsart: Allgemeinzulassung

Objektart: Funkanlage für Identifizierungszwecke

Das Zulassungsobjekt erfüllt die technische Vorschrift der Richtlinie FTZ 17 TR 2015, Ausgabe Juli 1988.

Saarbrücken, den 11.01.1995

Im Auftrag

Bernd Jung   1 Anlage

Bundesamt für Zulassungen in der Telekommunikation, Talstraße 34–42, D-66119 Saarbrücken, Tel.: (06 81) 5 98–0, Fax: (06 81) 5 98–16 00

2.3   Declaration of Conformity

Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG) vom 9. November 1992;

EG-Baumusterbescheinigungen für Sendefunkanlagen

Nach EMVG dürfen vom 01.01.1996 an nur noch Geräte in den Verkehr gebracht werden, die die Schutzanforderungen nach § 4 EMVG einhalten. Für Sendefunkanlagen ist gem. § 5, Abs. (4) die EG-Baumusterbescheinigung einer **gemeldeten Stelle** einzuholen.

Der Begriff "Inverkehrbringen" (= erstmalige entgeltliche oder unentgeltliche Bereitstellung eines Gerätes zum Zwecke seines Vertriebes und/oder seines Gebrauchs) im Sinne des EMVG bezieht sich hierbei auf <u>jedes einzelne Gerät</u>, das im Gebiet der Europäischen Union (EU) neu in den Verkehr gebracht wird, d. h. alle bisher erteilten nationalen Zulassungen für Sendefunkanlagen können vom 01.01.1996 an ohne EG-Baumusterbescheinigung nicht mehr genutzt werden.

Das Bundesamt für Zulassungen in der Telekommunikation (BZT) erteilt als gemeldete Stelle im Sinne des EMVG auf Antrag EG-Baumusterbescheinigungen für Sendefunkanlagen, sofern das Einhalten der folgenden Schutzanforderungen nachgewiesen wird:

Entsprechend § 4, Abs.(1) EMVG müssen **alle** Geräte, auch Sendefunkanlagen, so beschaffen sein, daß

1. die Erzeugung elektromagnetischer Störungen soweit begrenzt wird, daß ein bestimmungsgemäßer Betrieb von Funk- und Telekommunikationsgeräten sowie sonstigen Geräten möglich ist,

2. die Geräte eine angemessene Festigkeit gegen elektromagnetische Störungen aufweisen, so daß ein bestimmungsgemäßer Betrieb möglich ist.

Im Sinne des EMVG wird das Einhalten dieser Schutzanforderungen vermutet für Sendefunkanlagen, die entweder:

a) harmonisierten europäischen Normen oder

b) nationalen Normen, die nach Artikel 7 der EMV-Richtlinie von der Kommission und den anderen Mitgliedsstaaten der EG anerkannt sind, entsprechen.

Sofern derartige Normen nicht vorhanden sind oder nicht angewandt wurden, erteilt das BZT die EG-Baumusterbescheinigung auf der Basis von ETS-Standards bzw. ETS-Standardentwürfen (prETS bzw. Draft prETS).

Die technische Prüfung findet in den Labors des BZT oder in anderen für die entsprechende Norm oder den entsprechenden Standard akkreditierten Labors statt.

Anlage zum Zulassungsbescheid

3 Safety

3.1 Intended Use

STOP

Warning

The protection of operating personnel and plant is not guaranteed if the equipment is used for a purpose for which is was not intended.

The devices must only be operated by authorised specialist personnel in accordance with these operating instructions.

The microwave radiation produced by the device is less than 50 mW (EIRP - Equivalent Isotropic Radio Power) which is noticeably below the approved values in accordance with the BAPT 211 ZV 037/2050, April 1997 edition.

However, note that the device emits electromagnetic radiation during operation and therefore cannot be used in some environments. Especially for persons using hearing aids or pacemakers it is urgently recommended to consult a doctor, before putting the device into operation.

3.2 General Safety Instructions

STOP

Warning

Safety and correct functioning of the device cannot be guaranteed if operated in any way other than that described in this handbook.

The connection of the device and maintenance work under power must only be carried out by qualified electrotechnical personnel.

In the case that a failure cannot be repaired, the device must be taken out of operation and protected against inadvertently being put back into operation.

Repairs must only be carried out by the manufacturer. Additions or modifications to the equipment are not permitted. They render the warranty void.

The operator is responsible for complying with local safety regulations.

3.3 Functional Integrity/Functional Monitoring

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                                     Anlage 1 zur Zulassungsurkunde
                                     Nr. A116624F  vom 11.01.1995
                                     Vorgangs-Nr.: 40936        1
                                     Seite  1 (2)
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                         SYSTEMBESCHREIBUNG
```

```
Objektbestandteil:    1. Schreib-/Lesekopf: MWH 2000 F15
                      2. Schreib-/Lesekopf: MVH 2000 F15
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```
Objektmerkmale:

  Frequenzbereiche:            2,400 GHZ bis 2,500 GHz

  Betriebsfrequenz:            2,450 GHz

  Äquivalente isotrope         zu 1.: ≤ 20 mW
  Strahlungsleistung (EIRP):   zu 2.: ≤ 200 mW

  Sendeart:                    4M250 AXX

  Betriebsart:                 Simplex

  Datenrate:                   max. 19,2 kbit/s

  Spannungsversorgung:         15 V DC (extern)

  Antenne des Empfängers:      integrierte, gedruckte Antennenstruk-
                               turen zur Erzeugung zirkularer pola-
                               risierter RF-Energie

  Anzahl der schaltbaren HF-Kanäle:    1


Die o.g. Funkanlagen werden mit folgenden Systemkomponenten betrieben:
- Bedien- und Kontrollgeräte: MWI-AG-2HRX bzw.
                    MWI-DL-2HRX
- TAG: MMC-60-64k oder
       MMC-60-256k
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Anlage 1 zur Zulassungsurkunde
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Bedingungen und Auflagen

Die Bedingungen und Auflagen sind der "Verordnung über die Zulassung von Te-
lekommunikationseinrichtungen (TKZulV) vom April 1991" zu entnehmen.

Außerdem gilt:

1. Das Zulassungsobjekt muß vom Zulassungsinhaber wie folgt gekennzeichnet
   werden:
                     - Zulassungszeichen des BZT
                     - zusätzlicher Kennzeichnung
                     - Objektbezeichnung
                     - Zulassungsinhaber
                     - Seriennummer/Gerätenummer

Die zusätzlichen Kennzeichen sind dem Zulassungszeichen außerhalb der Umran-
dung rechts unten in gleicher Schrift und in Höhe der Jahresangabe anzufügen.

Die Kennzeichnung muß dauerhaft und abnutzungssicher ausgeführt und so mit
dem Gehäuse verbunden sein, daß sie beim Entfernen zerstört wird. Sie muß von
außen jederzeit sichtbar sein.

2. Es dürfen nur solche Objekte mit dem Zulassungszeichen gekennzeichnet wer-
den, die mit dem zugelassenen Objekt elektrisch und mechanisch übereinstim-
men, d.h. bau- und funktionsgleich sind.

3. Der Zulassungsinhaber ist verpflichtet, jeder mit dem Zulassungszeichen
gekennzeichneten Funkanlage einen Nachdruck dieser Zulassungsurkunde
beizufügen.

4. Dem Zulassungsinhaber ist es untersagt, für einen Betrieb des Zulassungs-
objektes zu werben, der nicht in Übereinstimmung mit den technischen Vor-
schriften und dem Verwendungszweck steht.

5. Alle an die Funkanlage anschließbaren Zusatzgeräte müssen den grundsätz-
lichen Anforderungen des Gesetzes über die elektromagnetische Verträglichkeit
von Geräten (EMVG) genügen. Als einschlägige nationale Normen im Sinne des
§ 4 Absatz 2 des EMVG gelten für die o. g. Funkanlagen folgende Normen: DIN
VDE 0876, DIN VDE 0877 und DIN VDE 0878.

Die Übergangsvorschriften (§ 13 des EMVG) sind zu beachten.

Hinweise:

Diese Zulassung ist keine Genehmigung zur Errichtung und zum Betrieb der
Funkanlage im Sinne des § 2 des Gesetzes über Fernmeldeanlagen (FAG).

Genehmigungen zum Betreiben dieser Funkanlage erteilt die für den Wohnsitz
des Antragstellers zuständige Außenstelle des Bundesamtes für Post und Tele-
kommunikation (BAPT).

4 Product Description

4.1 System Structure

The Microwave ID system IDENT-M consists of a control unit, read/write heads, and data carriers. The IDENT-M system sends and receives data between a host controller (personal computer) and data carriers. For communication between the read/write head and data carriers the IDENT-M system uses microwaves.

```
              ┌─────────────┐
              │    Host     │
              │  controller │
              └─────────────┘
                    ↕
        ┌─────────────────────┐
        │ Control interface unit │        MVI-D2-2HRX
        └─────────────────────┘
                    ↕
   ┌───────────────────────────┐
   │      Read/write head       │
   │   ┌───────────────────┐    │
   │   │   Control unit    │    │         MVH500-F15/
   │   └───────────────────┘    │         MVH2000-F15/
   │      ↑           ↓          │         MVH5000-F50
   │   ┌───────────────────┐    │
   │   │  Communication    │    │
   │   │    function       │    │
   │   └───────────────────┘    │
   └───────────────────────────┘
                 �️
           Microwave
          communication
                 ⇩
   ┌───────────────────────────┐
   │       Data carrier         │
   │   ┌───────────────────┐    │
   │   │  Communication    │    │         MVC-60-64K/
   │   │    function       │    │         MVC-60-256/
   │   └───────────────────┘    │         MVC-60B-64K
   │      ↑           ↓          │
   │   ┌───────────────────┐    │
   │   │     Memory        │    │
   │   └───────────────────┘    │
   └───────────────────────────┘
```
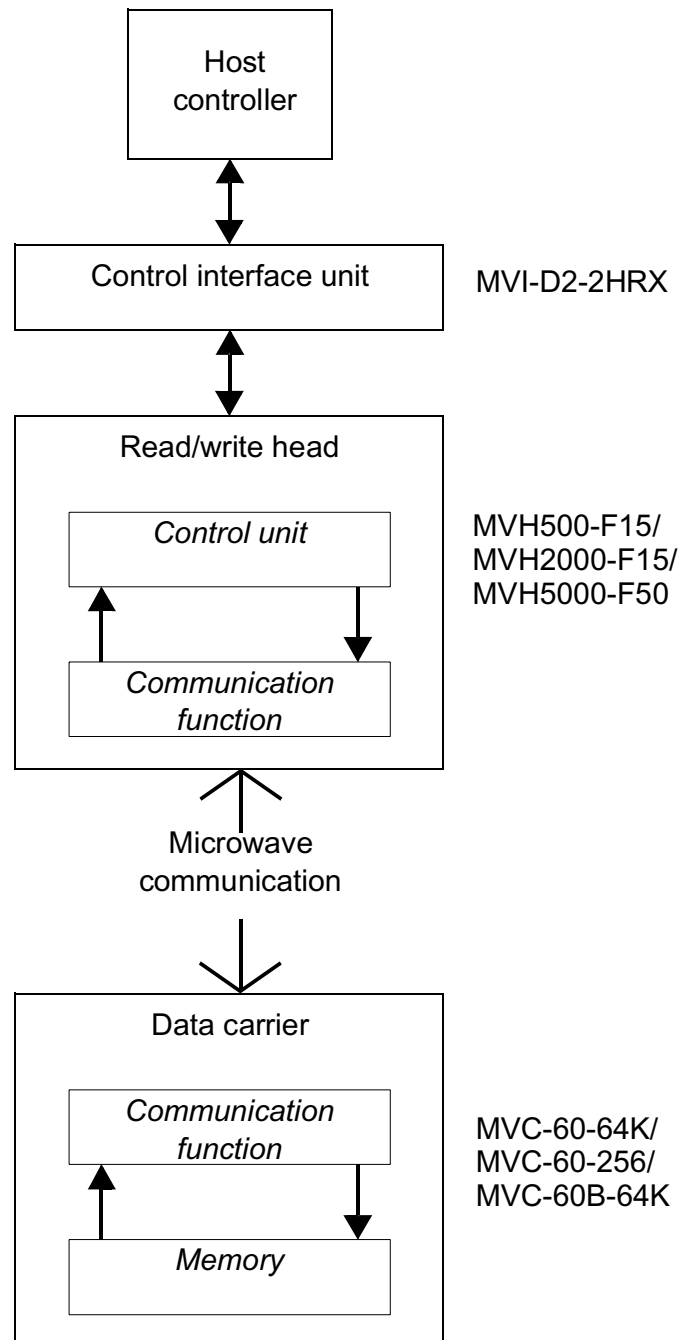
Multiple control units at one host controller:

(RS 422 interface)

Host controller
(e.g. personal computer)

* When connected via the RS 422 interface, a maximum of 16 MVI-D2-2HRX control interface units can be coupled together.

Max. transmission distance is 1,000 m.

RS 422

MVI-D2-2HRX
Station number "0"
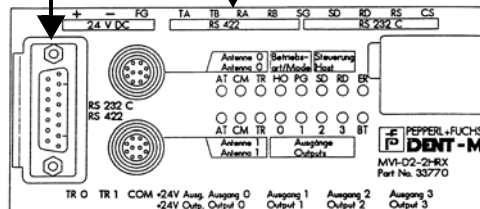
RS 422*

MVI-D2-2HRX
Station number "1"
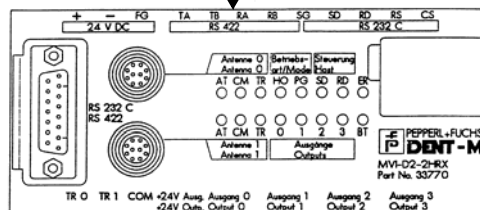
MVI-D2-2HRX
Station number "F"

Date of issue   03.05.2001
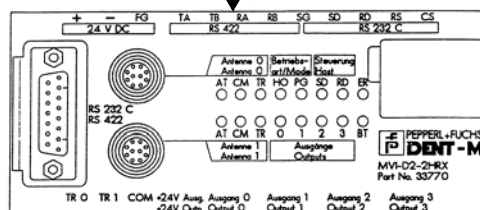
One control interface unit at one host controller:

(RS 232C interface)

*Max. transmission distance for a connection of an MVI-D2-2HRX control interface unit via the RS 232C interface is 15 m.

Host controller
(e.g. personal computer)

RS 232*

optionally
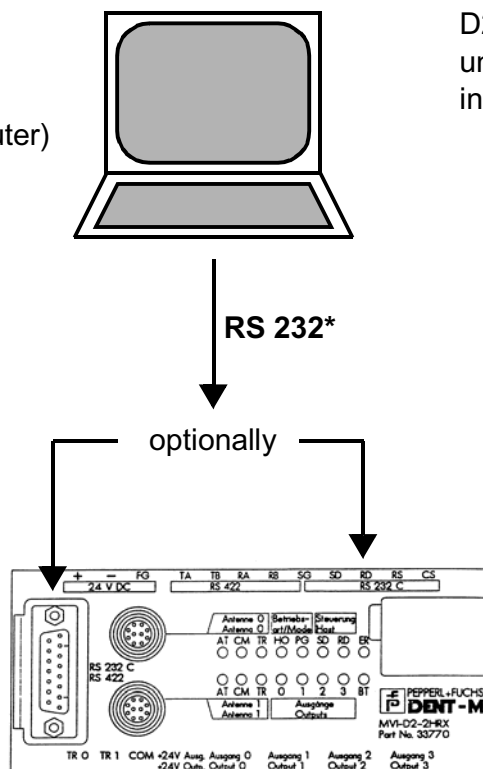
MVI-D2-2HRX

Control interface unit at one bus coupler:

(RS 422 interface)

INTERBUS   **PROFIBUS**

| Bus coupler MVG-KFD2-B5 | or | Bus coupler MVG-KFD2-B6 |

RS 422

optionally
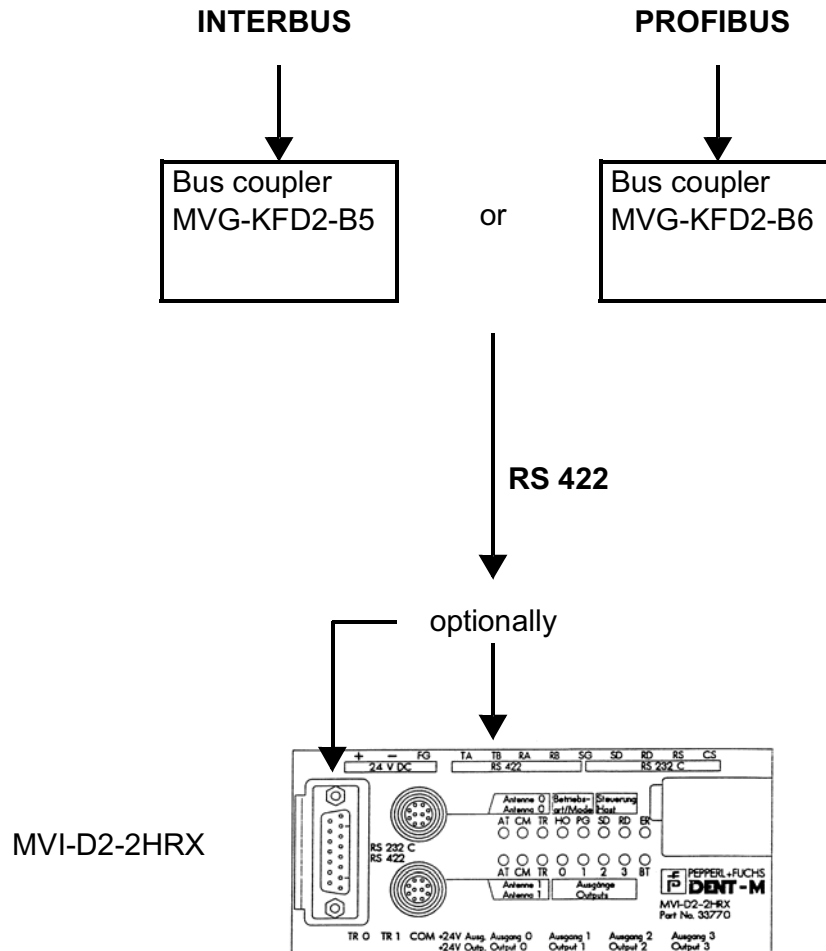
MVI-D2-2HRX

4.2 Components

4.2.1 MVI-D2-2HRX Control Interface Unit

The control interface unit controls the data transfer between the host controller and the data carriers. The control interface unit receives instructions from the host controller via serial interface RS 232C or RS 422.

- A maximum of 16 MVI-D2-2HRX control interface units can be controlled via interface.

- For data transmission between host controller and MVI-D2-2HRX either RS 232C or RS 422 interface is used. A terminal block or a connector system is used for connection.

- The read/write head automatically detects the existence of a data carrier and can send and receive data.

- The read/write head can communicate with a specific data carrier.

- The data transmission rate between the MVI-D2-2HRX, the read/write head (MVH500-F15/MVH2000-F15/MVH5000-F50) and the data carrier (MVC-60-64K) is 76.8 kbit/s.
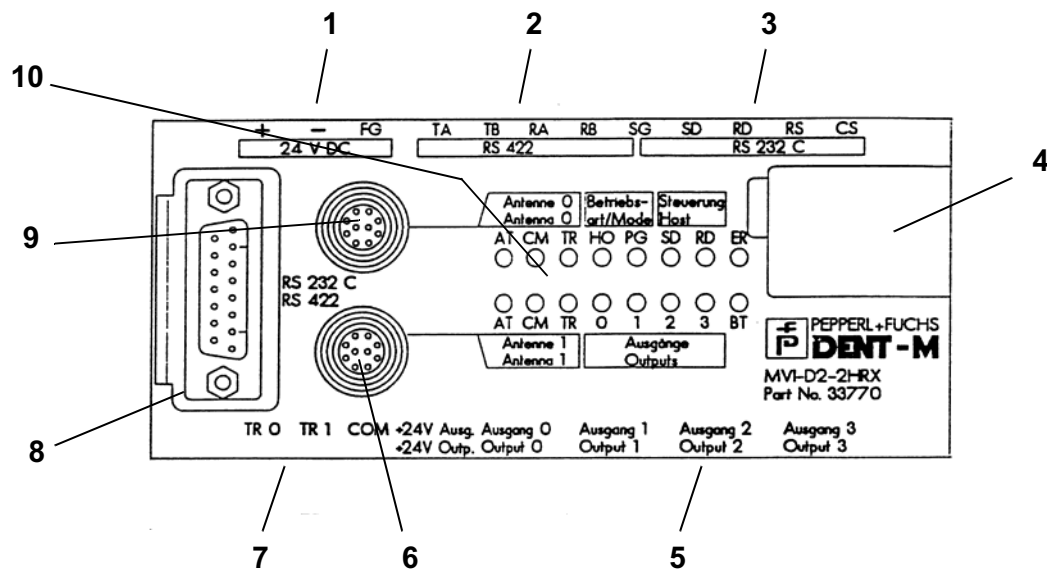
No.	Designation		Function
1	Power supply		Connection of the DC 24 V power supply
2	Host controller interface		RS 232C interface terminals
3	Interface		Terminals for RS 422 interface 1
4	Switch (under the cover)	SW 1	Setting the data length, parity, stop bit, connector type, data transmission standard, selection between 2-wire connection, 4-wire connection and high speed mode.
		SW 2	Setting the station number.
		SW 3	Setting the communication rate between host controller and MVI-D2-2HRX.
		SW 4	Setting the terminal resistance.
5	Outputs		
6	Connector 1		Connector for read/write head 1
7	Trigger inputs		
8	Interface for host controller		Connector for RS 232C and RS 422 interface 2
9	Connector 0		Connector for read/write head 0
10	Status indicator		Indicates the operating status (see next page).

IDENT-M System V
Product Description

Status indicator
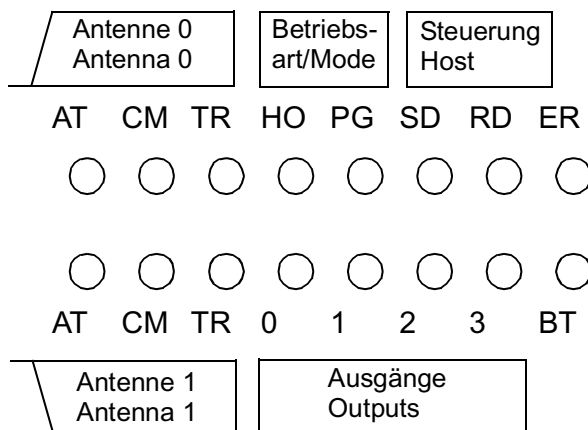
Designation of LED		Contents
AT	(Antenne 0)	Lights when a read/write head is connected to the 0/1 connector.
	(Antenna 1)	
CM	(Antenne 0)	Flashes when a read/write head is connected to the 0/1 connector, and when data transmissions take place between read/write head and a data carrier.
	(Antenna 1)	
TR	(Antenne 0)	Lights when a trigger signal for the read/write head 0/1 is due to be sent.
	(Antenna 1)	
HO	(Mode)	Lights when communication with a host controller is possible.
PG	(Mode)	Reserved.
SD	(Host)	Flashes when the MVI-D2-2HRX sends data to the host controller.
RD	(Host)	Flashes when the MVI-D2-2HRX receives data from the host controller.
ER		Lights when a transmission error occurs in communication with the host controller and goes OFF when the control unit receives a new command from the host controller.
		Lights when an error occurs while executing a command, and goes OFF when the control interface unit receives the reset command from the host controller.
0, 1, 2, 3	(Outputs)	Lights when the output is turned ON by instruction from the host controller (relay is switched). (Goes OFF when the relay is in the OFF position).
BT		Lights when the battery voltage of the integrated battery in the MVI-D2-2HRX is too low.

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4.2.2 Read/Write Heads MVH500-F15/MVH2000-F15/MVH5000-F50

The read/write head, which is controlled by the MVI-D2-2HRX, sends and receives data from data carriers, as long as the data carriers are located inside the transmission area. The read/write head transmits the received data to the MVI-D2-2HRX.

• For communication with the data carrier three models of read/write heads are available: MVH500-F15 for medium distance, MVH2000-F15 for long distance, MVH5000-F50 for extra long distance.

• 2.45 GHz microwaves are used for data transmission between read/write heads and data carriers. Since the read/write heads operate with circularly polarised microwaves, transmission interference due to metal reflection is minimised.
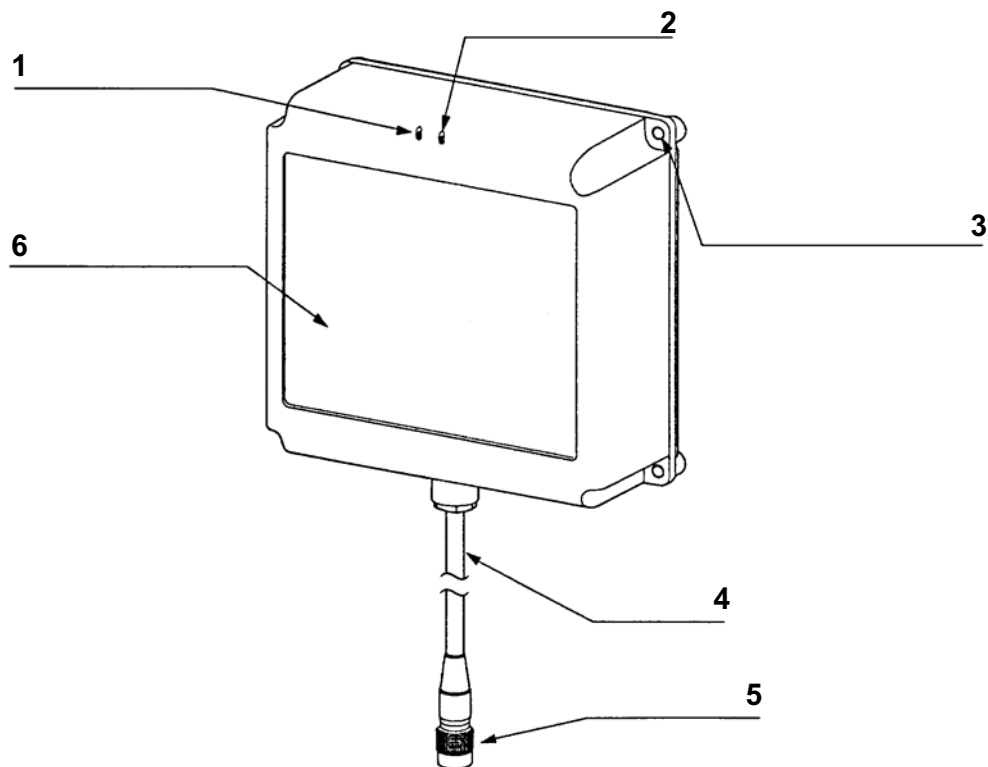
No.	Designation	
1	Status indicator TX	
2	Operation indicator OK	
3	Mounting holes	Mounting hole Ø4.5 mm
4	Read/write head cable	
5	Read/write head connector	
6	Front	Microwave communication

Date of issue   03.05.2001

4.2.3 Data Carriers MVC-60-64K/MVC-60-256K/MVC-60B-64K

The data carrier stores data from the read/write head inside the integrated memory or sends the data back to the read/write head.

• Installation allowance of the data carrier is ± 45° in the horizontal and the vertical directions and any position in the direction of rotation.

• Three types of data carriers with different memory capacity are available: the 8 kByte MVC-60-64K type, the 32 kByte MVC-60-256K type and the MVC-60B-64K type with replaceable battery.
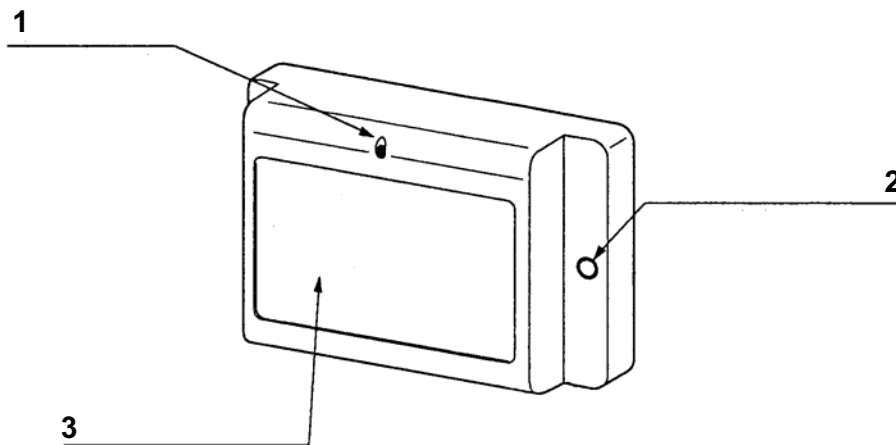
No.	Designation	
1	Operation indicator OK	
2	Mounting holes	Mounting hole Ø4.5 mm
3	Front	Microwave communication

4.2.4 Read/Write Head Extension Cable
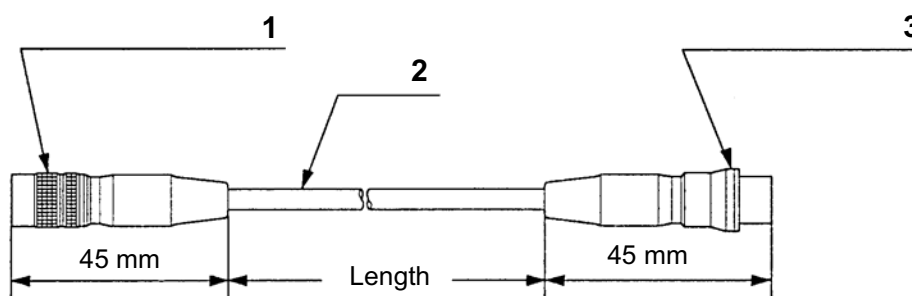
No.		Designation
1	Connector	To the MVI-D2-2HRX control interface unit
2	Cable	Ready made-up cable lengths: MVK-5: 5 m MVK-10: 10 m MVK-20: 20 m MVK-30: 30 m
3	Jack	To the read/write head

5 Installation

5.1 Storage and Transportation

The device should be well packed for transportation and storage, so that protection is provided against shock and dampness. Optimum protection is afforded by the original packaging. In addition, the permissible ambient conditions must prevail (see chapter 5.3 "Ambient Conditions").

5.2 Unpacking

Inspect the contents for damage. In the event of damage, the postal service or goods transport service should be informed and the supplier notified.

Inspect the contents of the delivery package against your order and the delivery documents:

- Quantity delivered

- Device type and version in accordance with the type plate

- Accessories

- Manual/manuals

Retain the original packaging in case the items have to be stored or further transported at a later date.

Please address any queries to Pepperl+Fuchs GmbH.

5.3 Ambient Conditions

Installation of Control Interface Unit

Do not install the control unit on the following locations:

- Locations exposed to direct sunlight or an ambient temperature falling below or exceeding 0 °C ... 55 °C.

- Locations where relative humidity exceeds or falls short of 35 % ... 90 %, or dew condensation occurs due to rapid temperature variation.

- Locations where corrosive vapour or inflammable gas is present.

- Locations where vibration or shock is directly transferred to the control interface unit.

Installation Read/Write Head and Data Carrier

Be sure to meet all the requirements described in chapter 5.4 "Selection of the Mounting Location" and chapter 5.5 "Mounting of Components".

Static Charge

In extremely dry conditions, the human body may be charged statically. This static charge may damage or destroy parts mounted on PC boards inside the control unit. Prior to handling the control unit, touch a metal object which is grounded to discharge static electricity.

Usage

The data carrier has a built-in lithium battery for data backup. The battery has a limited life span (MVC-60-64K and MVC-60-256K). Replace the data carrier with a new one before the batteries are exhausted. The battery of the MVC-60B-64K must be replaced in good time. Delay in replacement may cause malfunction of the data carrier. Battery life can be checked by referring to the production year, -month, storage time, operation time, and battery use ration by means of the program.

Cleaning

To clean the control interface unit, use a dry, soft cloth. Do not use any volatile solvent such as alcohol, thinner, freon, or even a wet cloth for cleaning, as this may cause a deformation or color change.

Storage

Since the control interface unit and the data carrier have lithium batteries inside, do not put them into fire. The lithium battery may explode or burn which is quite dangerous.

Do not lay the control interface unit face-down or put any weight on it.

Note

5.4 Selection of the Mounting Location

5.4.1 Positional Relation

On condition that there is no nearby object, the conical area shown in the illustration below represents the available transmission area (transmission range).

1   Data carrier
2   Data transmission area
3   Read/write head
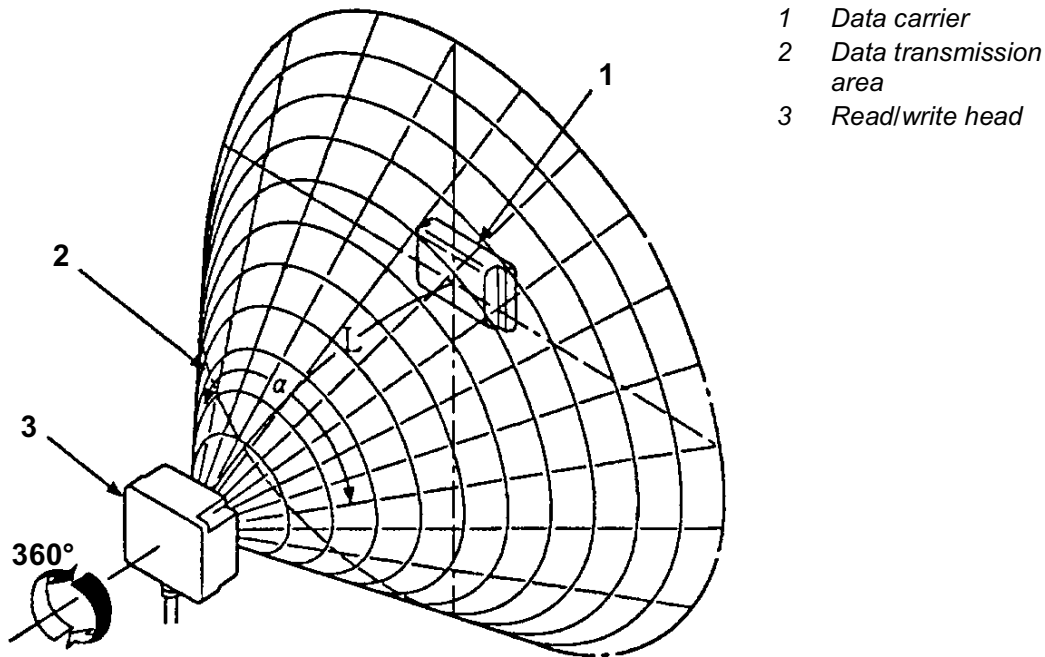
Figure 5.1: Transmission area of the read/write head

Read/write head	L	a	Applicable data carriers
MVH500-F15	500 mm	60°	MVC-60-64K MVC-60-256K MVC-60B-64K
MVH2000-F15	200 mm ... 2,000 mm	60°	
MVH5000-F50	5,000 mm	60°	

When the front angle of the data carrier and the front angle of the read/write head is between 0° and 45°, the data carrier's transmission area is reduced accordingly. When the data carrier is installed with a slant, reduce the distance between the read/write head and data carrier as much as possible.

Communication in area A is possible. However, this area may suffer interference from surroundings. Even in area B and near the area, existence of an object may change the transmission area or make a data transmission between the read/write head and the data carrier impossible within the recommended distance. For installation, first carefully check the transmission availability in a field test.

1   Data carrier
2   Read/write head
3   Pivoting angle 0°
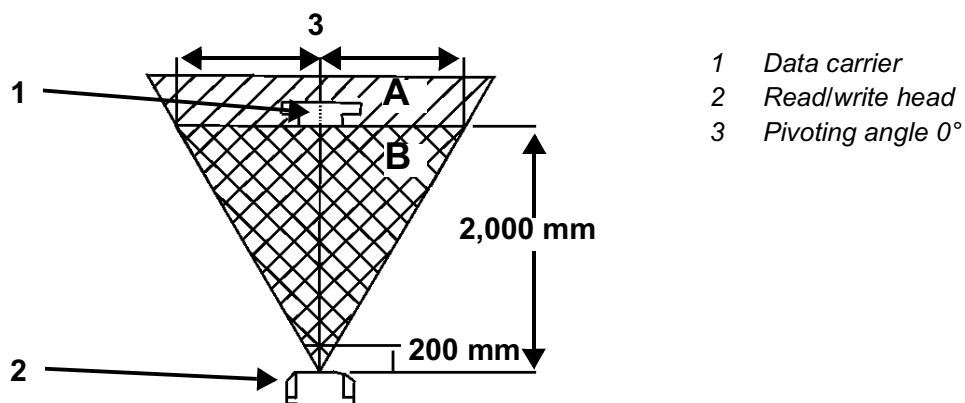
Figure 5.2: Communication area of the read/write head

5.4.2   Influence of Obstacles

When transmitting data between the read/write head and the data carrier, remove any reflective object (metal etc.) or dielectric object (human body or moist wooden material) from the data transmission area. When such an object is within the transmission area, (see figure 5.2) the transmission of microwaves may be interfered and therefore a normal transmission would not be possible.

Microwaves are reflected when they impinge upon a reflective object and they may be absorbed when they impinge upon a dielectric object.

A cover used to protect the read/write head or the data carrier should be made of plastic with low dielectric properties (polyethylene fluoride etc.). In addition, it must be ensured that the cover does not affect transmission in the current transmission system arrangement.

When reflective objects (such as metallic objects) are located near the read/write head or the data carrier, transmission errors may even occur within area **"A"** see figure 5.2. Please check the constant data transmission between the read/write head and the data carrier by simulating and testing the conditions of the current system arrangement.
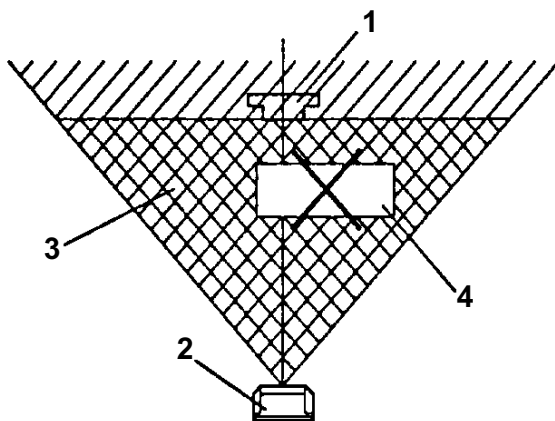
1	*Data carrier*
2	*Read/write head*
3	*Data transmission area*
4	*Reflective or dielectric object*

The IDENT-M microwave identification system uses circular polarised microwaves which advance while rotating, and thus lower the influence of a reflective object or an adjacent system.
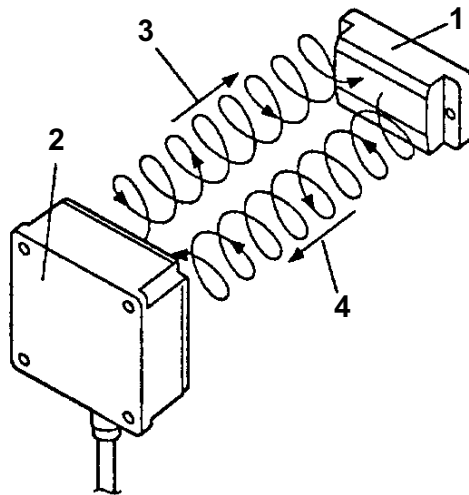
1   Data carrier
2   Read/write head
3   Microwave from the read/write head
4   Microwave from the data carrier

Transmission function	Microwave from the read/write head	Microwave from the data carrier
Read	Clockwise rotation of polarised wave	Clockwise rotation
Write	Counter-clockwise rotation of polarised wave	–

When a microwave strikes a reflecting object, it is reflected like a light beam on a mirror. Within this process, the rotation of the polarised wave reverses its sense of direction.

1 Read/write head
2 Reflection object
3 First reflected wave
4 Second reflected wave
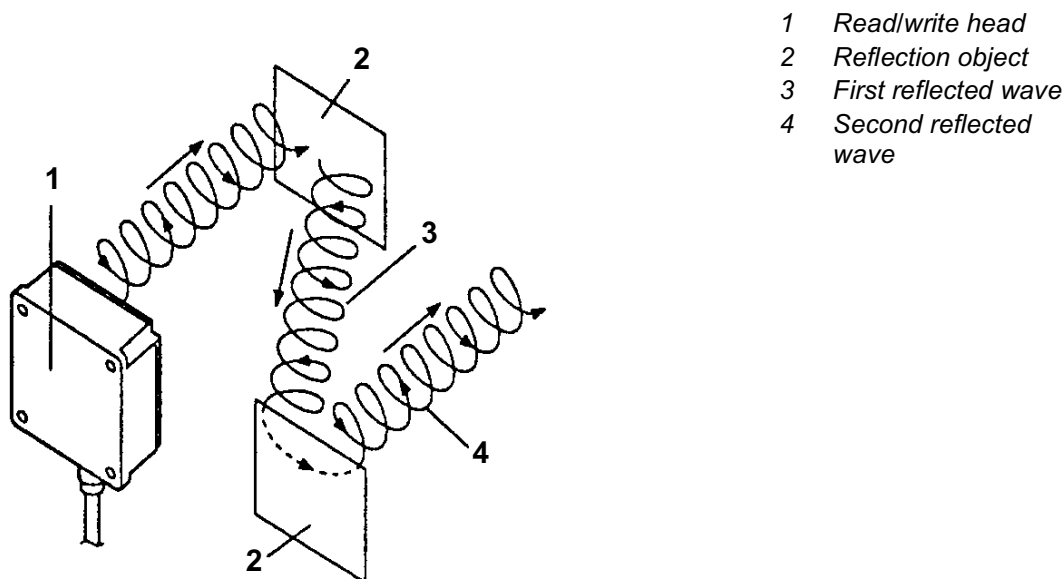
Communica-tion function	Microwave reflected by a reflective object	
	First (odd) reflected wave	Second (even) reflected wave
Read	Counter-clockwise rotation	Clockwise rotation
Write	Clockwise rotation	Counter-clockwise rotation

• The unique or odd times reflected wave does not influence the data transmission, since the rotation direction is in reverse sense.

• The even times reflected wave weakens, since the distance between the read/write head and the data carrier is longer than the direct wave from the read/write head, so that the data carrier can eliminate the reflected wave within its receive circuit. A transfer error occurs, when the data carrier cannot eliminate the reflected wave in its receive circuit, since the intensity of the reflected wave equals the intensity of the direct wave.

5.4.3 Influence of Liquids

(Rain, snow, coolants, cleaning liquids, human bodies)

Make sure that no water film forms between the data carrier and the read/write head, while transmitting data to the data carrier.

Thermal Influence of Microwaves

• When microwaves are projected on water, water molecules are separated and oscillated. Friction heat caused by colliding molecules increases the water temperature.

• When there is a water film between the data carrier and the read/write head, radio wave energy is converted into thermal energy and the radio wave attenuates. Therefore, the available transmission distance is reduced.
Note: Oil is not activated by microwaves and therefore does not reduce the available transmission distance.

• 70 % of the human body consists of water so that transmission is not possible, when there is human body between the data carrier and the read/write head.

Reduction of the Actual Transmission Distance

• The available transmission distance is neither reduced by individual water-drops on the data carrier or the read/write head surface nor by moistening the surfaces with water.

• When the data carrier is dipped into water, or when there is a waterfall between the data carrier and the read/write head, the maximum transmission distance reduces according to the waterfall's thickness.

Water film thickness	None	1 mm	5 mm	10 mm	50 mm
MVH500-F15	2,000 mm	1,300 mm	300 mm	30 mm	5 mm
MVH2000-F15	4,000 mm	2,500 mm	700 mm	100 mm	10 mm

Influence of Rain and Snow

• The transmission distance is not influenced by rain or snowfall occuring between the data carrier and the read/write head.

• When the data carrier or the read/write head are operated during heavy snowfall or rain, a water film may form on them causing the transmission distance to diminish.

• When the data carrier or the read/write head is covered with dry snow or snow crystals, the molecules are not separated by microwaves and the radio waves can pass through the snow. However, wet snow may attenuate radio waves and reduce the transmission distance.

Influence of Coolants

When using a water-soluble coolant for working processes, it must be ensured that no coolant film forms between the data carrier and the read/write head during the transmission process.

1. Install a valve, in order to stop the coolant supply during the transmission process.

2. Be careful to install the data carrier and the read/write head at a place where a coolant film cannot form during transmission.

3. Use a device (a shade or a pail), to prevent the flow of coolant so that no coolant film forms between the data carrier and the read/write head.

Influence of Cleaning Liquids

- When pallets or workpieces are cleaned, while installing the data carrier, it must be ensured that no water film forms on the surfaces of the data carriers (vapours caused by cleaning liquids do not affect the transmission).

- When installing a plastic protective cover on the front side of the data carrier, it must be ensured that no cleaning liquid remains inside the cover plate.

5.4.4 Influence of Metallic Objects

(Conveyor belts, pallets, machines and workpieces)

Since radio waves reflected by metal objects close to the data carrier and the read/write head come from different directions, the angle and the height of the read/write head have to be adjusted so that transfer errors due to multiple transmission are prevented.

Microwave Reflection of Metal Objects

- Microwaves are characteristically reflected by metallic objects. When a metallic object is located close to the data carrier or the read/write head, the data carrier receives direct radio waves from the read/write head as well as radio waves reflected from metallic objects. When direct radio waves and reflected radio waves arrive in reverse phase difference, these two radio waves cancel each other out and the radio signal weakens. The same applies to radio waves from the data carrier to the read/write head.

- When using a data carrier in a production line, metallic objects with complex shapes may be near the data carrier and the read/write head. Therefore, they receive reflected waves from different directions. In order to prevent this, measures must be taken to screen the reflected waves.

Presence of a Metallic Object with Complex Reflective Surface

The IDENT-M microwave identification system uses a circularly polarised wave system and is also screened, to prevent the influence of metal reflection. Some shapes of metal objects or their arrangement next to the data carrier and the read/write head may cause the transmission not to function trouble-free. When direct or double reflected waves reach the receiver with the same intensity, the radio signal may be attenuated or changed.

Measures against Reflected Waves

Altering the read/write head installation angle changes the direction of the reflected wave which superimposes the direct wave. In this way, it is possible to eliminate transmission errors.

1. Planning the arrangement
   Provide an angle adjustment function for the read/write head, thereby enabling it to be adjusted to ±30° in up/down and left/right direction against the crossing point of the read/write head central axis as well as the data carrier distance.

2. Adjusting the arrangement
   Adjust the read/write head angle in order to minimise the transmission distance between the data carrier and the read/write head.

1	*Read/write head*
2	*Dust guard*
3	*Angle of rotation*
4	*Axis of rotation*
5	*Angle slide direction*
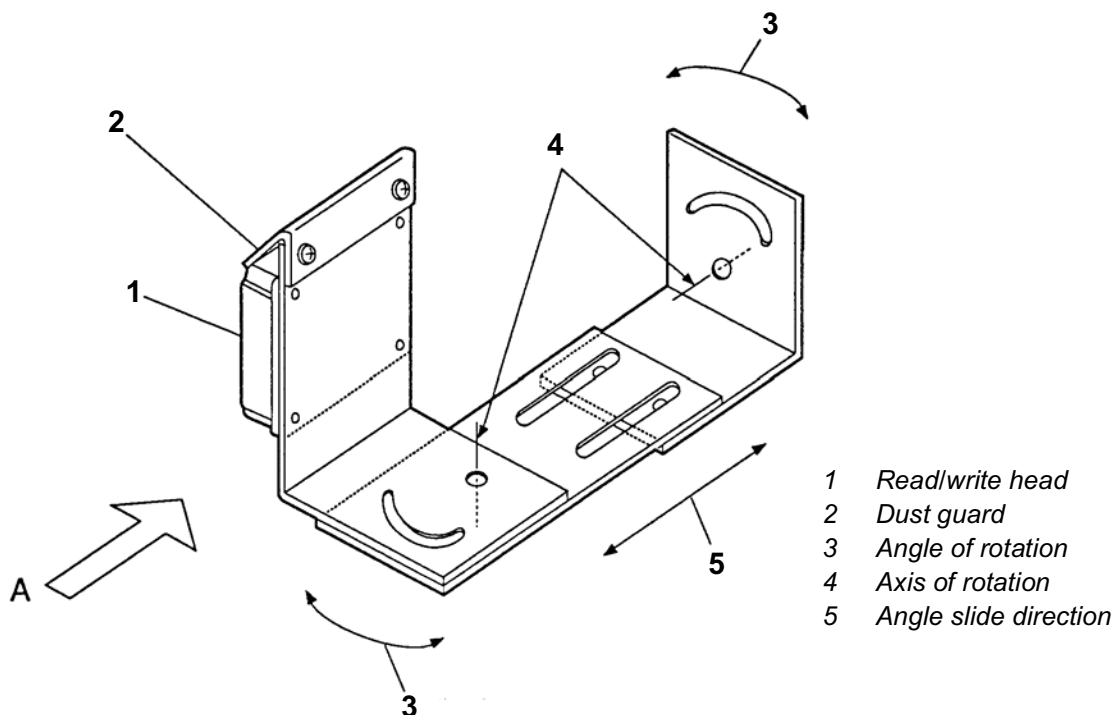
Sectional drawing "A"
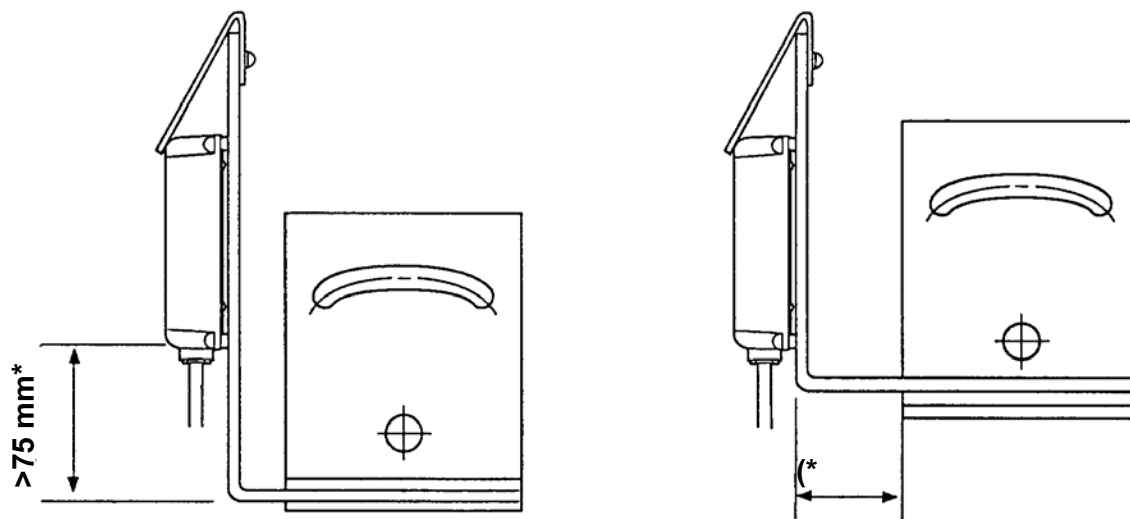
* Be careful to observe the minimum distance, to protect the cable when it is moved.

Influence of Casting Dust (Cutting powder, slag)

When casting dust settles on the data carrier or on the read/write head, the radio waves may attenuate thereby reducing the available transmission distance. When using the data carriers and the read/write heads in a metal processing plant, precautions must be taken to prevent cutting dust from settling on the devices.

Attenuation of Radio Waves due to Metal Dust, Oscillation of Metal Dust

- The microwave system uses 2.45 GHz radio waves. The 2.45 GHz radio wave has a wave length of 122 mm and resonates with metallic objects, that have approximately 1/2, 1/4 or 1/8 of this wave length. This may attenuate the radio wave energy.

- When a metallic object with 10 mm length of side adheres to the data carrier or the read/write head, the occuring resonance may cause the radio signal to attenuate and the transmission distance to be reduced.

Reflection by Metal Dust

Large amounts of metal dust or sliced particles may reflect microwaves, attenuate the radio signal and reduce the transmission distance.

Settling of Cutting Dust during Cutting Procedures

1. When the data carrier or the read/write head is mounted vertically and its surface is moist from coolant, fine metal dust may settle on the surface which can cause the radio wave to attenuate a bit, however, without reducing the transmission distance.

2. When cutting dust settles on the upper side of the data carrier or the read/write head, it may drop on their front sides and considerably reduce the transmission distance (see figure 5.3).

3. When mounting the data carrier or the read/write head in an upright position it must be ensured that cutting dust does not accumulate on its surface.

Methods to Prevent Metal Dust Accumulation

The following measures have proved to be advantageous for the application:

1. When transmission is stopped, use a steam jet or compressed air to remove the cutting dust from the data carrier or the read/write head.

2. Provide plastic protective covers in order to protect the data carrier and the read/write head from accumulating cutting dust (see figure 5.4).
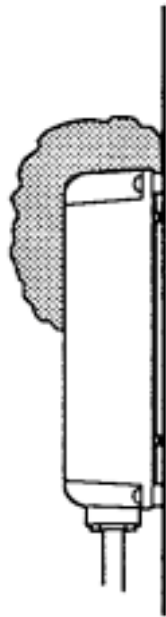
Figure 5.3: Dust accumulates on top of the read/write head and drops to its front side.
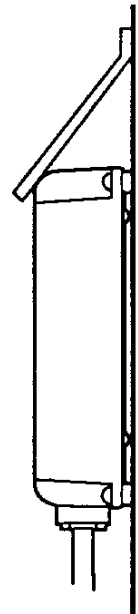
Figure 5.4: Use a plastic cover with the steepest possible slope angle thereby preventing dust accumulation on top of the housing.

5.4.5 Mounting Distance
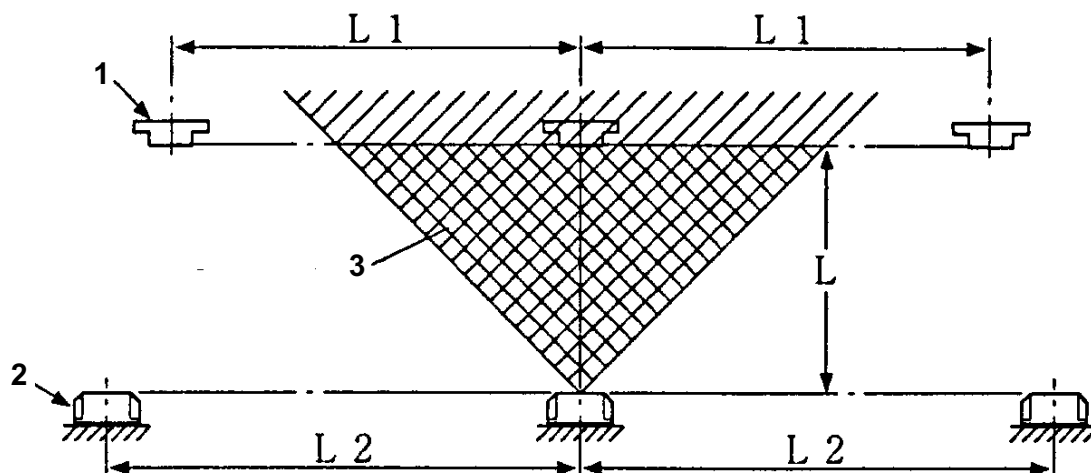
1 Read/write head
2 Data carrier
3 Data transmission range

Mount the data carrier and the read/write head observing the distances L1 and L2 listed in the table below.

Read/write head	Recommended distance between read/write head and data carrier (L)	Specified distance between neighbouring data carriers (L1)	Specified distance between neighbouring read/write heads (L2)
MVH500-F15	0 mm ... 500 mm (L)	longer than 2 x L >1 m	longer than 4 x L >2 m
MVH2000-F15	200 mm ... 2,000 mm	>4 m	>8 m
MVH5000-F50	500 mm ... 5,000 mm	>8 m	>16 m

When the "Detection time unlimited system" (Auto Read) operating mode is selected as preset transmission mode, L1 must be double the distance shown above. The following measures should be observed, when distances L1 and L2 cannot be maintained in your production line:

• Use a read/write head with a smaller transmission range.

• Reduce distance L and choose an arrangement in which the data carriers are moved through non-interfering transmission areas of the neighbouring read/write heads.

• Activate the data carriers via their ID codes.

• When several read/write heads are located within the L2 range, program them in such a way that the read/write heads do not communicate simultaneously.

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Note

When there is an object near the system, the data carrier may cause a transfer error despite the above-mentioned distances being observed. For this reason, simulate the arrangement of the system under present conditions in the field.

When the distance between neighbouring read/write heads is too short, the data carrier may receive radio waves from the neighbouring read/write head.
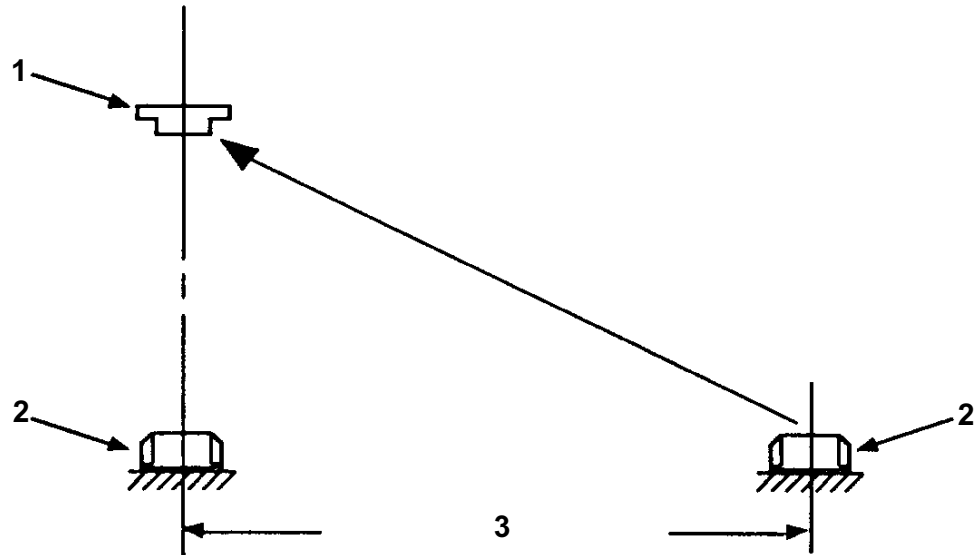
1   Data carrier
2   Read/write head
3   Distance between neighbouring read/write heads

1. Prevent both read/write heads from being operated at the same time.

2. Turn the read/write head mounting angle in such a way that the radio waves cannot reach the neighbouring data carrier.

3. If the neighbouring read/write head is disturbed by interferences, the influenced system retries the transmission process, provided that it is a transfer error due to interferences. (When the neighbouring transfer is finished, the disturbed side does not receive interferences upon retry).

4. Install a metal plate in order to prevent the radio waves from radiating to the neighbouring system.

When the distance between neighbouring read/write heads is short, the data carrier may receive radio waves from the neighbouring read/write head.
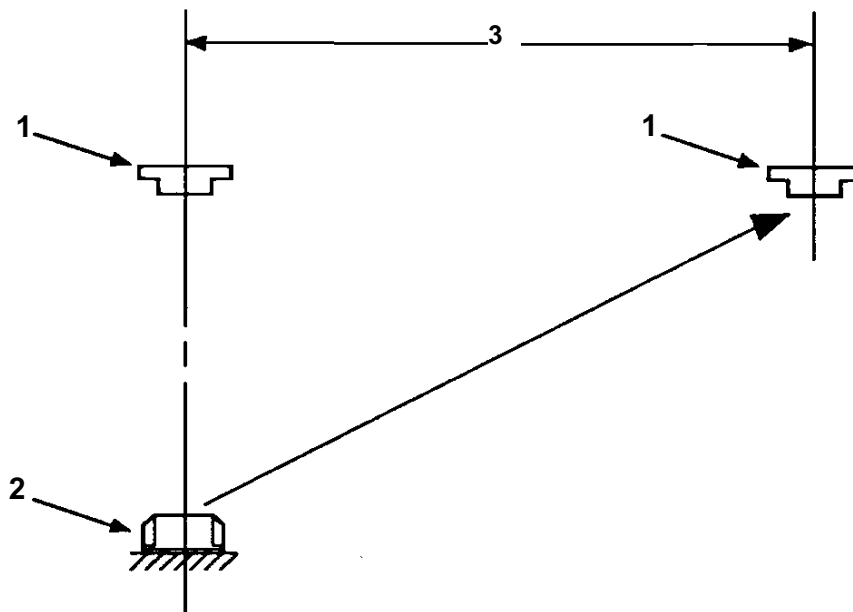
1   Data carrier
2   Read/write head
3   Distance between neighbouring data carriers

1.   Perform the transmission in the "ID-code assignment" mode

2.   Install a metal plate in order to screen the neighbouring data carriers from radio waves.

5.4.6   Rate of Motion of the Data Carrier

While moving, the data carrier can transmit data by means of the read/write head. However, its rate of motion is limited during the transmission process. The following maximum speed should be observed:

Maximum permissible speed: $S = \dfrac{W}{T_C}$

S [m/s]:   Maximum permissible speed of the data carrier during the transmission process.

W [mm]:   Width of the transmission range, within which the data carrier moves during the data transmission to the read/write head.

T_C [ms]:   Transfer time between read/write head and data carrier (see table on page 37).

Transfer Time between Read/Write Head and Data Carrier: T_C

"T_C" can be calculated from the function contents and the number of transmission Bytes. The following transmission conditions apply:

Preset transmission mode:	Detection time limited system without ID-code assignment
Data carrier LED:	Does not light
Execution of the data carrier's top address:	0000_h
Transmission retry:	No

Transmission function	Transm. code (octal)	Calculation of transmission time T_C (ms) (B as number of transmission Bytes)
Read	10_h	$T_C = 11.3 + 0.143 \cdot B + M1 \cdot 0.5 + M2 \cdot 5.59$
Read and check	11_h	$T_C = 16.4 + 0.286 \cdot B + M1 + M2 \cdot 11.2$
Read ID code	12_h	$T_C = 7.5$
Write	20_h	$B \leq 256$ Bytes $T_C = 23.4 + 0.143 \cdot B + M1 \cdot 0.5 + M2 \cdot 7.6$
		$B \geq 257$ Bytes $T_C = 24.6 + 0.143 \cdot B + M1 \cdot 0.5 + M2 \cdot 7.89$
Write and check	21_h	$B \leq 256$ Bytes $T_C = 28.3 + 0.286 \cdot B + M1 + M2 \cdot 12.9$
		$B \geq 257$ Bytes $T_C = 29.8 + 0.286 \cdot B + M1 + M2 \cdot 13.5$
Write ID code	22_h	$T_C = 12.2$
Clear	30_h	$T_C = 13.7 + 0.006 \cdot B$
Initialise data carrier	31_h	$T_C = 26.7$
Self-diagnosis of data carrier	50_h	$T_C = 81.7 + 0.008 \cdot B$
ROM check	51_h	$T_C = 61.2$
RAM check	52_h	$T_C = 13.2 + 0008 \cdot B$
Data carrier battery life check	53_h	$T_C = 24.6$
Block check	60_h	$T_C = 13.2 + 0.0032 \cdot B$

Variables of formulas:	B:	Number of transfer Bytes
	M1:	Round down the decimal of B/128 (e.g.: 32/128 = 0)
	M2:	Round down the decimal of B/256 (e.g.: 513/256 = 2)

Example: The following illustration shows the read/write head reading 512 Byte data when the pallet passes point A

1	Read/write head
2	Data transmission range
3	MVC data carrier
4	Direction of travel
5	Pallet
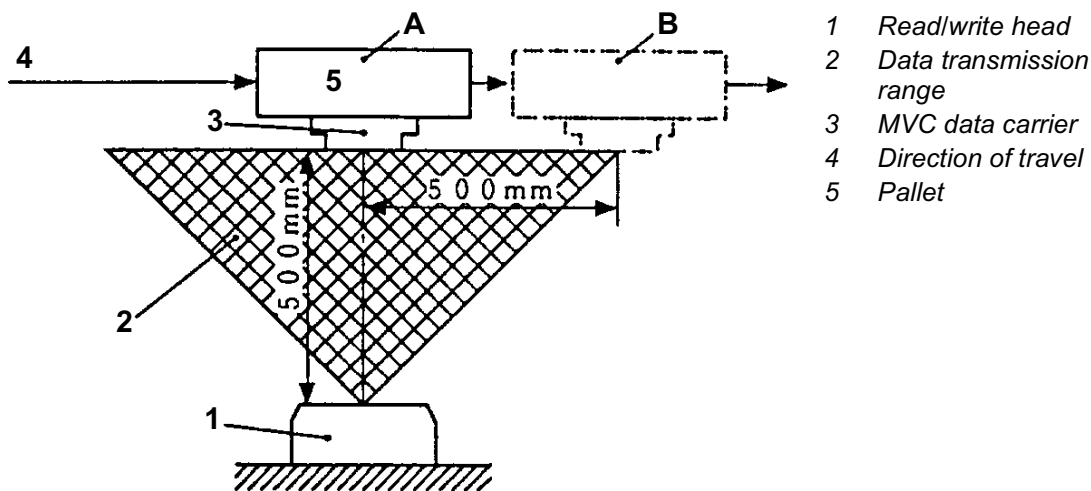
Before position B is passed (data carrier leaves transmission range of read/write head), the pallet should have already finished the read process. The maximum rate of motion of the data carrier in this arrangement is S (in m/s). Reading of 512 byte data (transfer code: 10_h) results in the following maximum speed:

$T_C = 11.3 + 0.143 \cdot 512 + M1 \cdot 0.5 + M2 \cdot 5.59$

$M1 = 512 \div 128$

$M2 = 512 \div 256$

$T_C = 97.7$ ms

$S = 500 \div 97.7 = 5.1$ m/s

The maximum rate of motion of the pallet is 5.1 m/s.

5.5 Mounting of Components

5.5.1 MVI-D2-2HRX Control Interface Unit

Be sure to mount the control interface unit as far away as possible from excessive noise, high voltage lines, high voltage devices, electric cables and units which generate radio waves.

Install the interface unit on a vertical surface.

Vertical installation   *Horizontal installation*
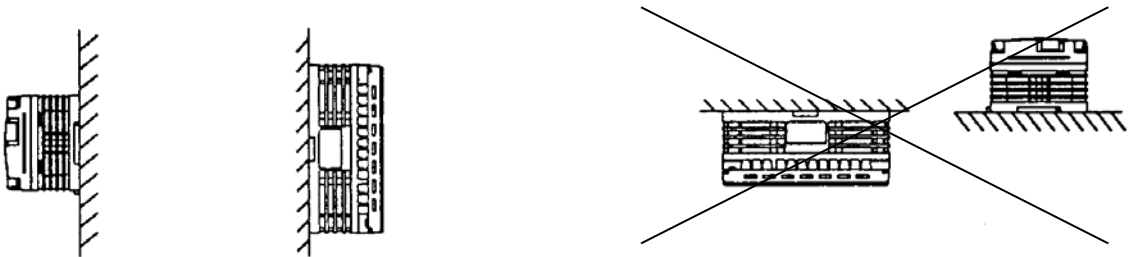
Direct Installation

When installing the control interface unit directly on a panel, M4 screws of at least 20 mm length should be used. Observe a space of at least 10 mm to the left and right and at least 20 mm on the top and bottom side of the MVI-D2-2HRX.
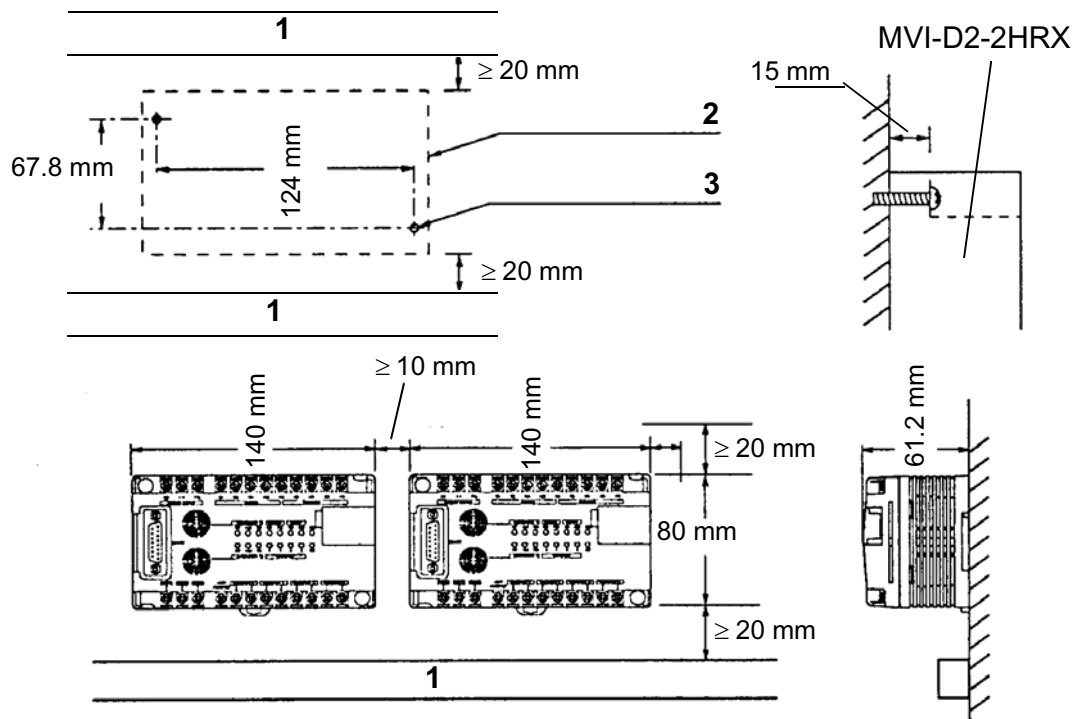
1   Cable ducts
2   Cutout 140 mm x 80 mm
3   2 x M4 threads or 4.5 mm Øholes

DIN Rail Mounting

Use of a DIN rail with 35 mm rail width fixed by the end plates.

Mounting
Position the backside groove of the control inter-
face unit on the DIN rail and press it down in arrow
direction.
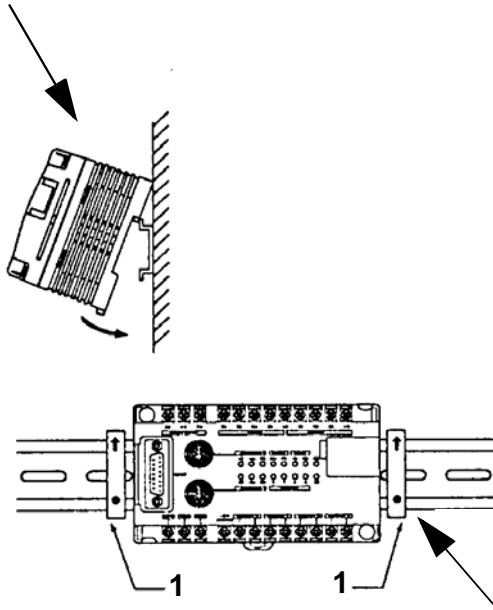
Disassembly
Bend open the modules by means of a
screw driver and remove the control
interface unit from the DIN rail.
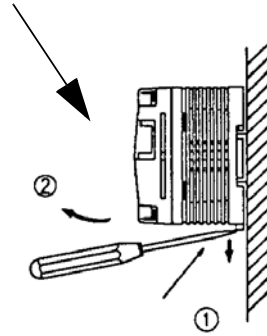
Fixing
Make sure the control interface unit is fastened by
means of end brackets (1).

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5.5.2 Read/Write Heads
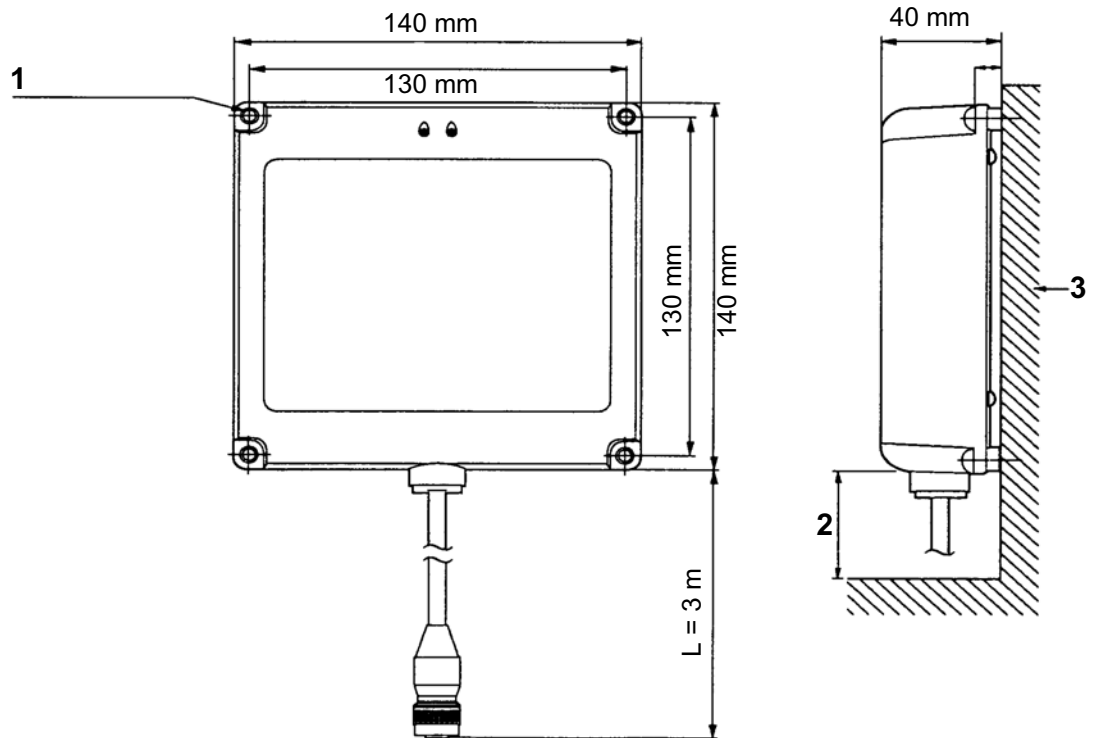
1 4 x Ø4.5 mm hole, depth 8 mm
2 ≥ 75 mm for bending the cable
3 Transportation plant or the like

Mounting in Metal Housing

Metal housing

≤ 40 mm
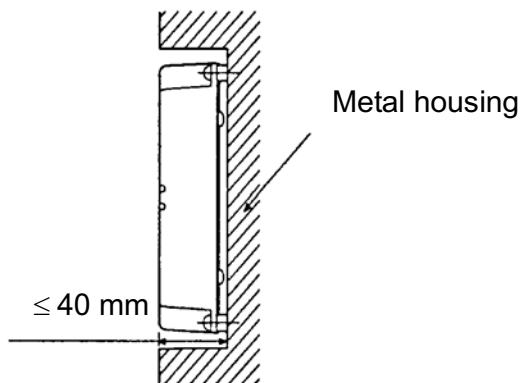
Mounting the read/write head in a metal object. The dimensions for the mounting depth of the read/write head, listed below, should be observed. Mounting the read/write head deeper than indicated, causes the specified transfer range to diminish.

Mounting in Humid Rooms

The read/write head has to be mounted in such a way that no liquid can penetrate the housing through the cable exit, when there is precipitation in humid rooms.
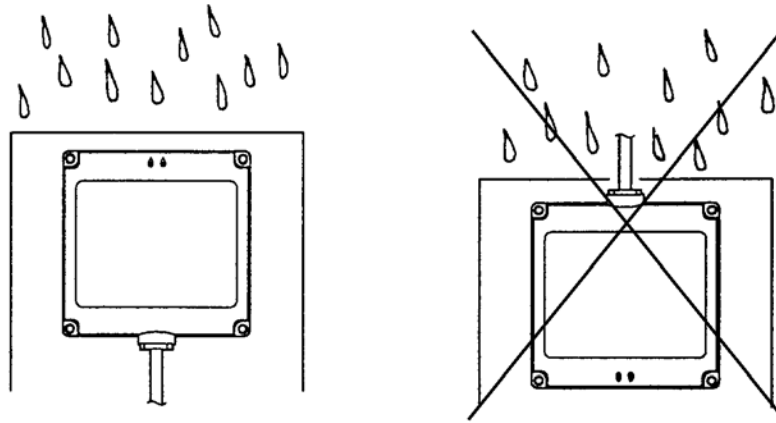
5.5.3 Data Carrier

Mounting the Data Carrier by Means of Screws

Fix the data carrier by means of M4 screws through mounting screw holes, for instance onto a pallet.
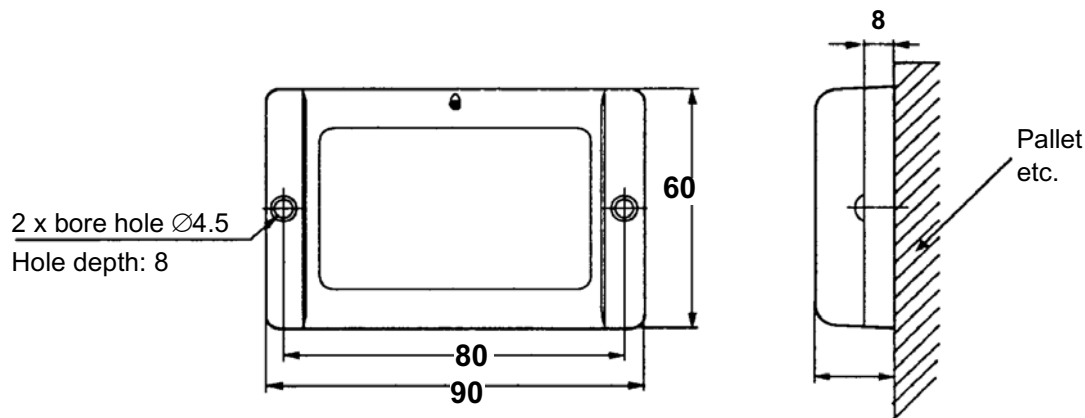
Mounting the Data Carrier in a Metal Housing

The dimensions for the mounting depth of the data carrier, listed below, should be observed. Mounting the read/write head deeper than indicated, causes the specified transfer range to diminish.

Metal

≤ 20 mm
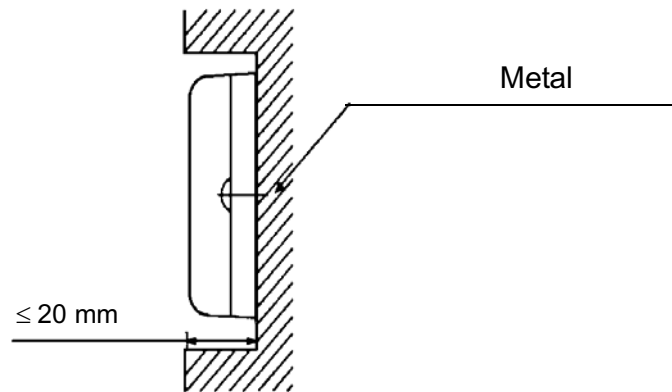
Using an Installation Holder

In order to facilitate the replacement of the data carrier in the system, we recommend manufacturing an installation holder **(1)**. The use of such a holder simplifies the replacement of the data carrier for maintenance and repair.

≥ 10 mm

≥ 8.5 mm

20 mm

60 mm

1

≥ 71 mm
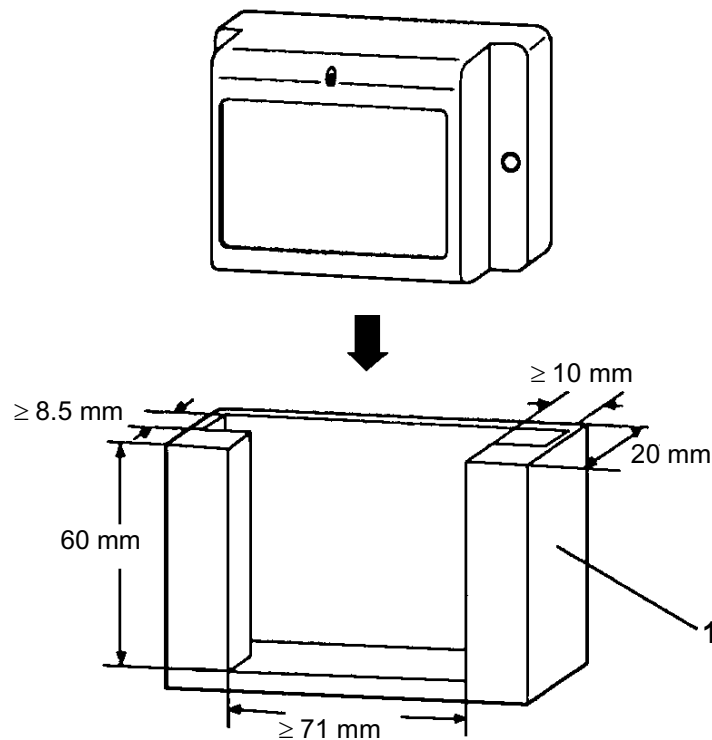
5.6 Connections of the MVI-D2-2HRX Control Interface Unit

5.6.1 Overview
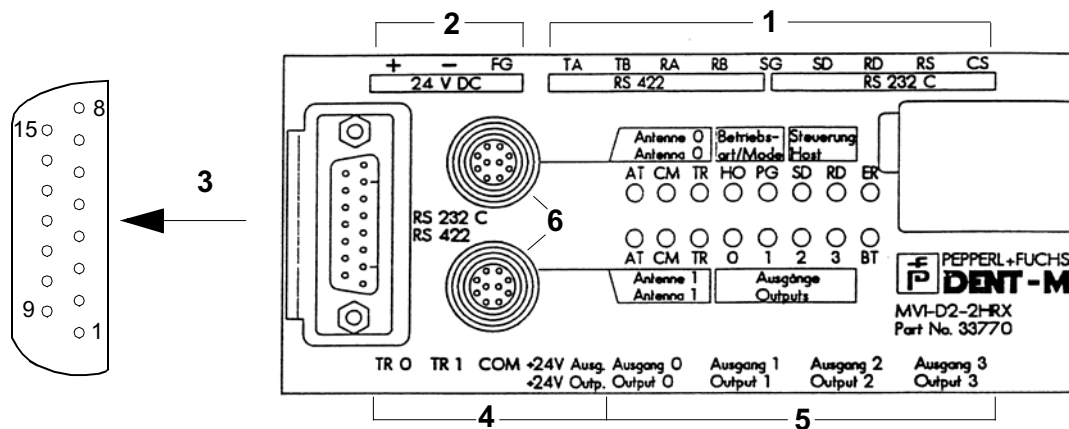
Fig.	Assignment	
1	Terminals for RS 232/RS 422 interface	
2	Terminals for DC 24 V power supply	
3	Connectors for RS 232 /RS 422 interface to the host controller	
	PIN No.	Signal
	1	FG
	2	SD
	3	TA (+)
	4	RD
	5	RTS
	6	SG
	7	SG
	8	CS
	9	RA (+)
	10	RB (-)
	11	TB (-)
	12	RS
	13	RTS
	14	+5 V
	15	+5 V
4	Terminals for the trigger input	
5	Terminals for the outputs	
6	Connections for two read/write heads	

Terminals

All terminals of the MVI-D2-2HRX are mounted with M3 screws. Use crimp terminals and tighten them with a torque of 4 to 8 kg/cm.

Recommended crimp terminals:
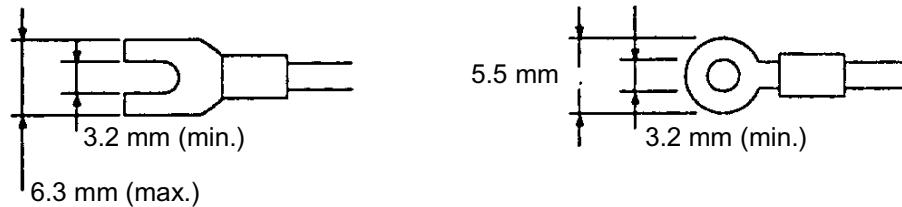
5.6.2 Connection of the MVI-D2-2HRX Control Interface Unit

Take the connector of the read/write head (1) for connecting it to the control interface unit and match the protrusions of the connector (2) with the dents of the MVI-D2-2HRX connector plug. Then press in and push the sliding bushing (3) forwards. When a "click" sound is heard, the connection is completed. In order to release the connection, pull the sliding bushing (3) backwards and unplug the connector (1).
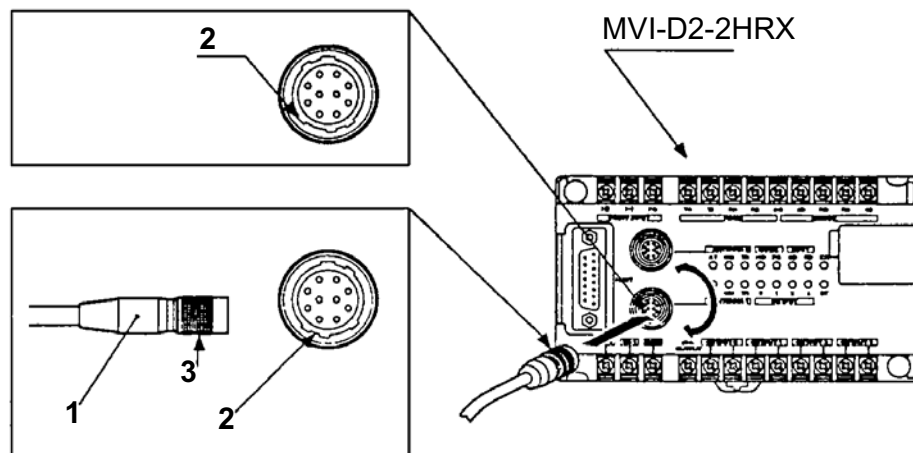
Connection of extension cable MVK-5/ MVK-10/ MVK-20/ MVK-30

The length of the read/write head connection cables, is indicated in the data sheets. When a longer cable is required, use any of the extension cables (MVK-5/ MVK-10/ MVK-20/ MVK-30) with the appropriate length. The number given in the type code corresponds to the length in meters.
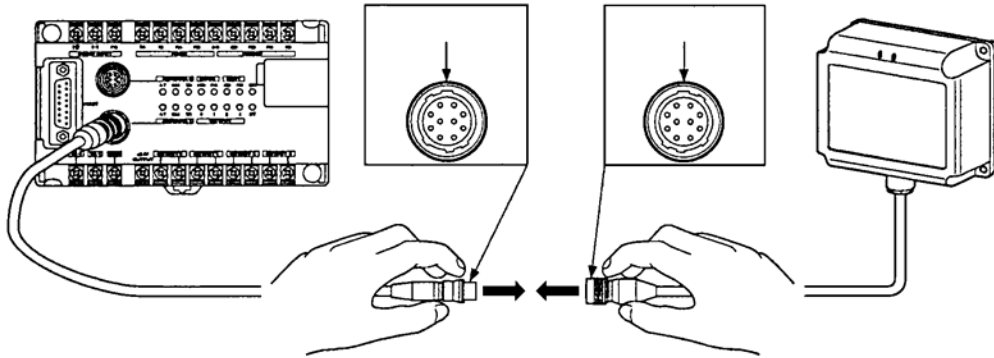
Attention

The read/write heads connector of the extension cable is not waterproof. Therefore, this connection of the read/write head should not come into contact with water. If the connection must be waterproof, we advise to use self-adhesive insulating tape.
When the extension cable has a loose connection, this may lead to a malfunction of the control interface unit. Make sure, the connection is fixed, so that it may not work loose.

5.6.3 Connecting the MVI-D2-2HRX Control Interface Unit to a Host Controller

For connecting the host controller to the MVI-D2-2HRX, both RS 232C and RS 422 are available as standard interface types. Choose one of the interface systems by setting switch 1 to 6. For connecting the interface, refer to the connection diagrams given below.

RS 232

The following table shows the signal names of the terminals for the RS 232C connection as well as the pin numbers of the connector for the MVI-D2-2HRX host controller.

Sig-nal	Pin No.	Function	
FG	1	Connect with frame ground	Frame ground
SD	2	Sends data (from MVI-D2-2HRX to host controller)	Send Data
RD	4	Receives data (from host controller to MVI-D2-2HRX)	Receive Data
SG	6,7	Signal ground	Signal Ground
CS	8	ON: MVI-D2-2HRX can send data OFF: Sending data locked	Clear to Send
RS	12	Switches ON while MVI-D2-2HRX operates	Request to Send

IBM PC   Screen   MVI-D2-2HRX

Signal	Pin No.
R D	2
S D	3
G N D	5
C D	1
D T R	4
D S R	6
C T S	8

Signal name	Pin No.
F G	1
S D	2
R D	4
S G	6、7
C S	8
R S	1 2

≤ 15 m
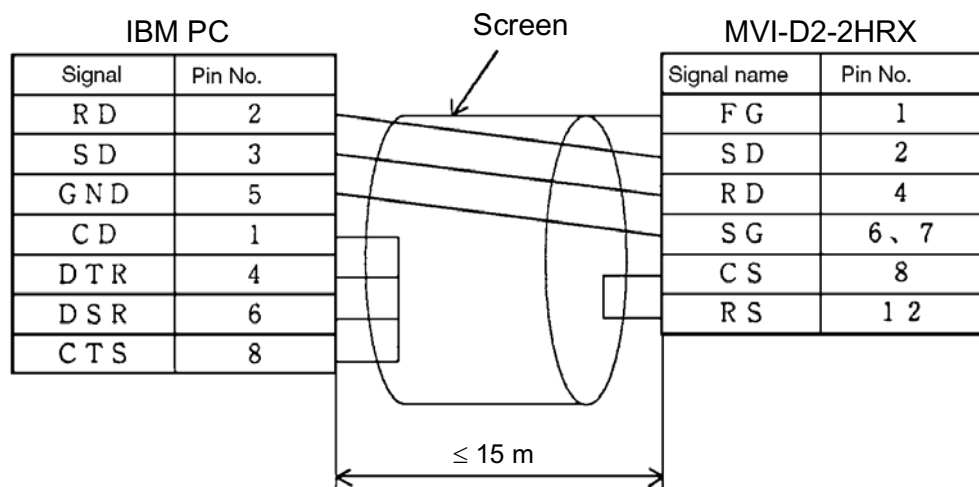
The length of the RS 232 interface cable must not exceed 15 m.

Note

RS 422

The following table shows the signal names of the terminals for the RS 422 connection as well as the pin numbers of the connector for the MVI-D2-2HRX.

Sig-nal	Pin No.	Function	
FG	1	Connect with frame ground	Frame ground
TA (+)	3	Sends data (from MVI-D2-2HRX to host controller)	Transmit data
TB (-)	11		
RA (+)	9	Receives data (from host controller to MVI-D2-2HRX)	Receive Data
RB (-)	10		

Computer			MVI-D2-2HRX				MVI-D2-2HRX	
Signal		Screen	Signal	Pin Nr.		Screen	Signal	Pin Nr.
F G			F G	1			F G	1
R X D			T A	3			T A	3
$\overline{R X D}$			T B	1 1			T B	1 1
T X D			R A	9			R A	9
$\overline{T X D}$			R B	1 0			R B	1 0
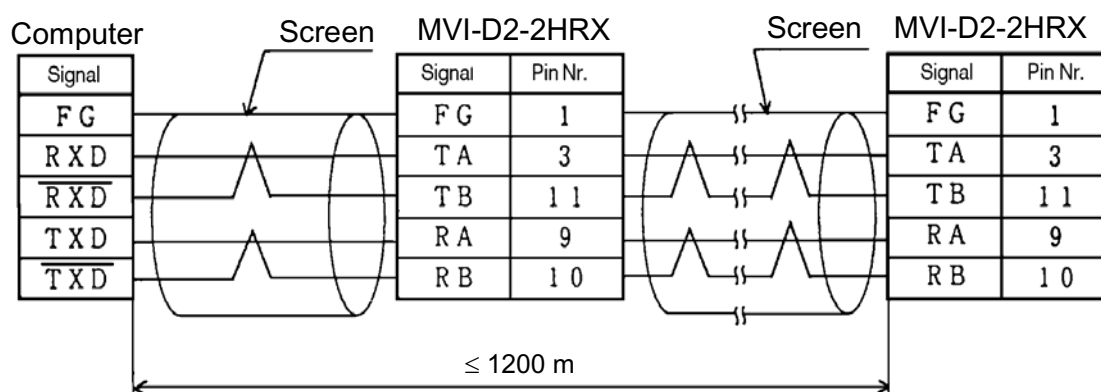
≤ 1200 m

Note

The length of the RS 422 interface cable must not exceed 1,200 m. We recommend cable type:

UNITRONIC® -Li1YCY (TP)

5.6.4 Connection to the Trigger Inputs

Connect a DC input to the trigger input as shown in the following figure:
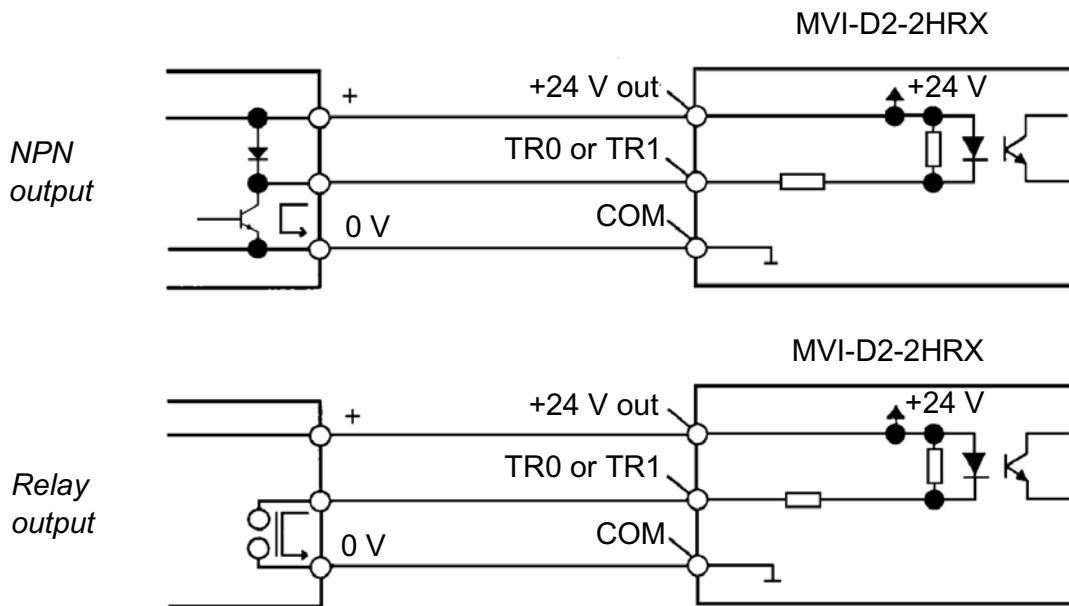
5.6.5 Connection of the Outputs

Connect output terminals "OUTPUT 0, 1, 2, and 3" according to the following instructions.

Protection against Shorted Output

When the output is shorted, the output circuit of the control interface unit may be destroyed. That is why a fuse should be integrated in order to protect the output.

Precautions against Surge Currents at Lamp Load

An incandescent lamp can generate a surge 10 to 20 times greater than the nominal current. Two precautions can be taken in order to decrease the surge: Inserting a bleeder resistor or inserting a current limiting resistor.

Inserting Bleeder Resistor
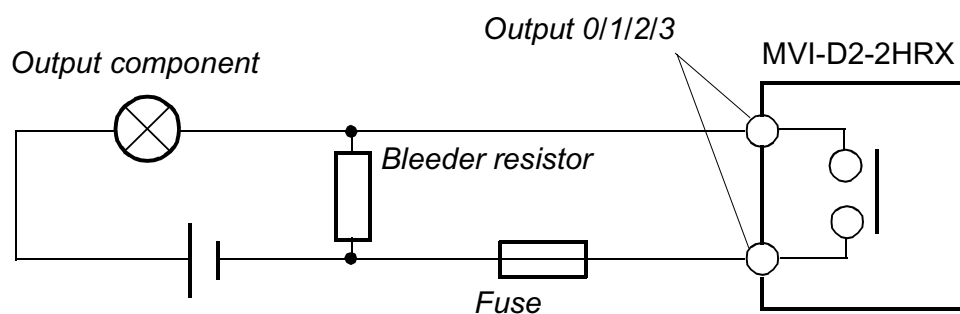
Supplies only low current so that the lamp does not light while the output is switched off.

Pepperl+Fuchs Group • Tel.: Germany (06 21) 7 76-0 • USA (330) 4 25 35 55 • Singapore 7 79 90 91 • Internet http://www.pepperl-fuchs.com   **49**

Inserting Current Limiting Resistor
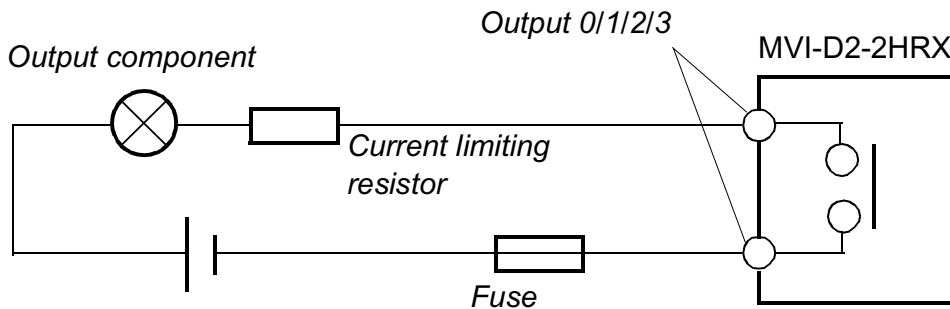
The resistor limits the current to the nominal current. The current supplying the lamp decreases, when the resistance is high. Adjust the resistance value, so that the lamp lights bright enough.

Protective Measures against Surges in Inductive Loads

When the circuit is opened by a coil, some thousand volts of voltage surge may occur, depending on the coil. When a coil generates a high voltage, appropriate protective measures should be taken against the surge. Protective measures against voltage surge may extend the lifetime of the relay.

• Protective measures against voltage surge

In the case of alternating voltage, varistors show the same effect as RC modules.
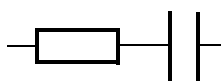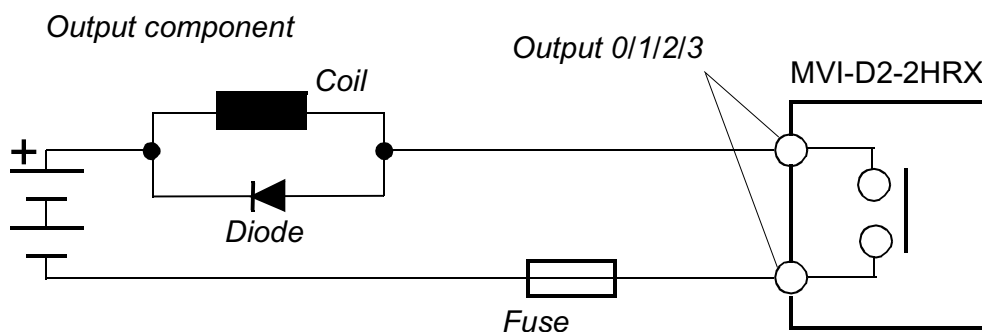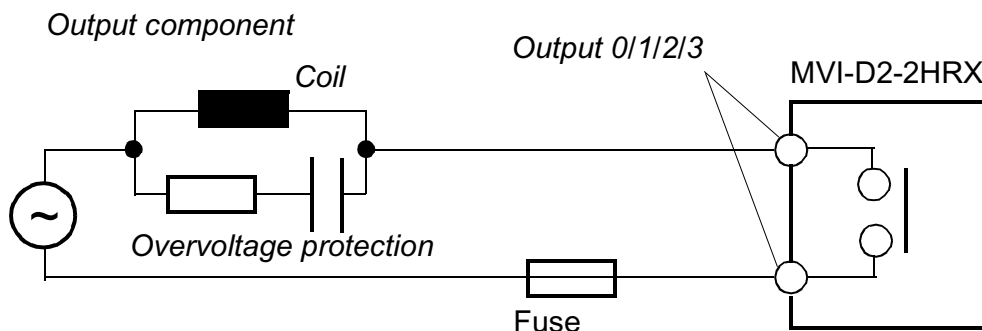
RC module:
C: *0.033 μF ... 0.33 μF (with $U_C \geq 250$ VAC)*
R: 47 Ω ... 120 Ω

Diode: The peak off-state voltage should be higher than 300 % of the nominal voltage. The rectified current should be higher than the nominal current.

Connection of low-voltage devices (24 VDC, 10 mA)

In the case of low tension and weak current, a reliable contact is established to the opposite equipment by means of a miniature relay. In the case of alternating voltage, the effect is the same when using a varistor instead of an RC overload protection. Mounting both, RC overload protection and varistor has a better effect.
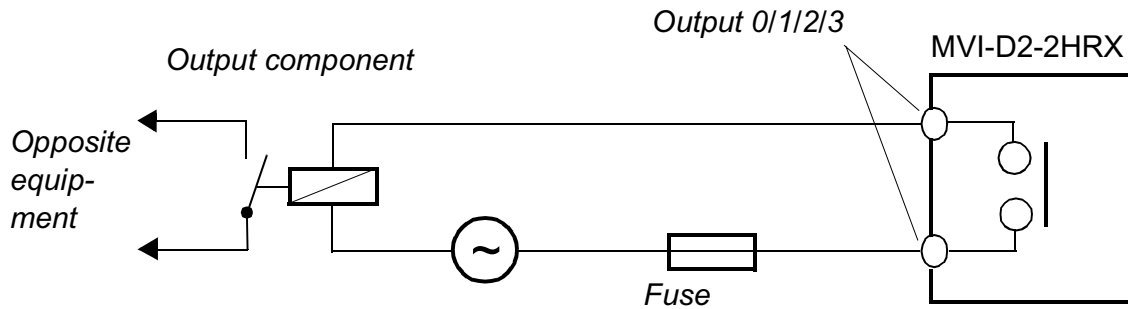
5.6.6 Connection of the Power Supply

Connect the current source with 24 VDC to the MVI-D2-2HRX power supply connection.

Power supply:

Power supply	24 VDC ±10 % (including ripple voltage, value at the MVI-D2-2HRX connection)
Amperage	More than 1 A
Ripple voltage	Less than 200 mV (at maximum load)

24 VDC

⟨−⟩   ⟨+⟩

Fuse
1.2 A

GND
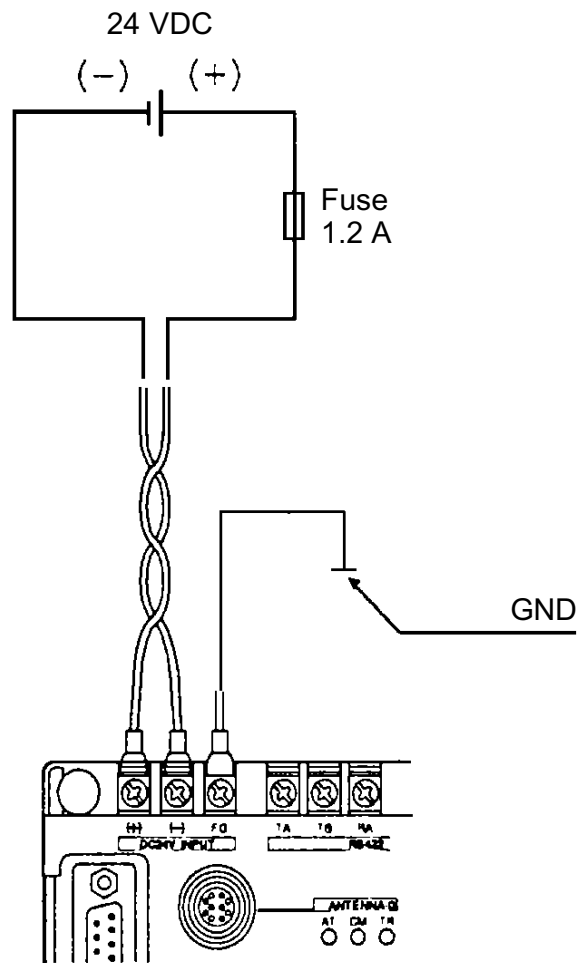
Note

Be careful not to mistake positive and negative poles at the MVI-D2-2HRX power supply connection. Mistaking the poles may damage the MVI-D2-2HRX and the read/write heads.

5.7 Dismantling, Packing and Disposal

Repacking

The device should be well packed for reuse, so that protection is provided against shock and dampness. Optimum protection is afforded by the original packaging.

Disposal

Electronic waste is special refuse. Be sure to observe the local regulations for its disposal.

Note

6 Commissioning

6.1 Check List

STOP

Warning

Before commissioning, make sure that the plant in which the device is integrated, cannot be damaged e.g. by uncontrolled trigger processes.

!

Attention

Before commissioning, check once again that the connections are correct.

6.2 Adjusting the Switches on the MVI-D2-2HRX Control Interface Unit

The switches are located underneath a cover on the control interface unit.

The transmission conditions between a host controller and the control interface unit are set by means of the switches.

Open the cover in the direction of the arrow. Set the SW2 and SW3 rotary switches using a 0.5 x 2.0 slotted screwdriver (see 1). Set the SW1 and SW4 DIP-switches using a pointed tool or a ball point pen (see 2).
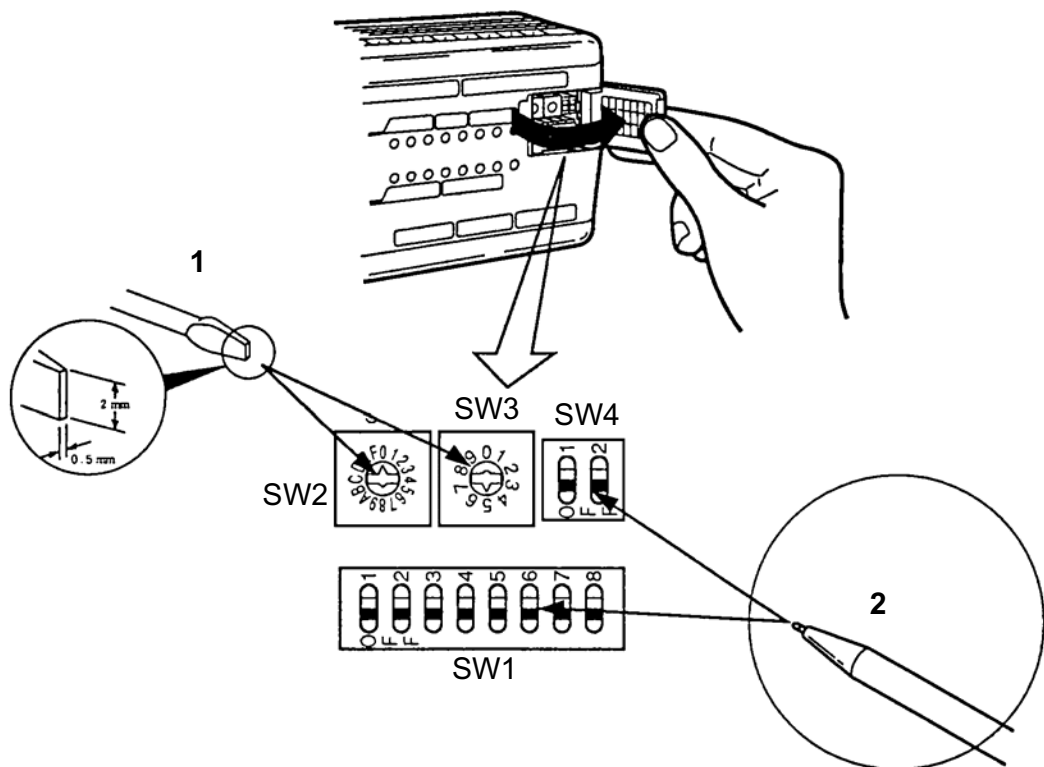
SW1:

Adjustment of data length, parity, stop bit, type of connection, data transfer standard, 2 or 4-wire system and high speed mode. Positions identified with "●" in the tables represent the basic settings at the delivery.
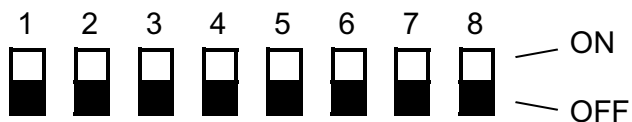
Data bits	SW1-1
8 bit	ON
● 7 bit	OFF

Parity	SW1-2	SW1-3
Even	ON	OFF
Odd	ON	ON
● None	OFF	*)

*) ON or OFF - basic setting is OFF.

Stop bits	SW1-4
2 bit	ON
● 1 bit	OFF

Connection type	SW1-5
● Host controller has a serial interface	OFF*

*) Make sure, SW1-5 is always set to OFF.

Wiring standard*)	SW1-6	SW1-7
RS 422 (4-wire connection)	ON	OFF
RS 422 (2-wire connection)	OFF	ON
● RS 232C	OFF	OFF

*) Connection see chapter 4.1 "System Structure"

Mode of operation	SW1-8
● High speed mode	OFF

*) Make sure, SW1-8 is always set to OFF.

SW2:

Set station number "0" to "F" (RS 422).
(Normal position: "0")

SW3:

Set transmission speed.
(Normal position: 5)
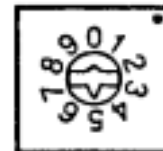
Transmission speed (baud)	Switch position
300	0
600	1
1200	2
2400	3
4800	4
9600	5
19200	6

Switch positions 7, 8 and 9 are reserved.

SW4:

Set terminal resistance.
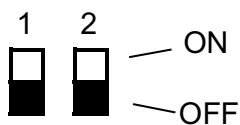
	SW4-1 (for 2-wire connection)	SW4-2 (for 4-wire connection)
Terminal station	ON	ON
Interstation	OFF	OFF

7 Communication Systems

7.1 Overview

You can choose between four **communication startup systems** and two **response return systems** for communication between the host controller and the MVI-D2-2HRX control interface unit.

Communication startup system	Response return system
Occasional execution system	Auto response system
	Response request system
Command stay system	Auto response system
	Response request system
Command register system	Auto response system
	Response request system
Read/write head scan system	Auto response system
	Response request system

When the occasional execution system or the command stay system are chosen as communication startup system, the MVI-D2-2HRX can simultaneously execute multiple commands (see page 57 and page 87 "Simultaneous Processing of Commands").

7.1.1 Communication Startup System

Based on the conditions for the MVI-D2-2HRX trigger inputs, the communication startup system is classified as follows:

Communication startup system	
Occasional execution system	Trigger input is not used
Command stay system	Communication with the data carriers is triggered by the sensor which is connected to the trigger input.
Command register system	
Read/write head scan system	Trigger input is not used

- Commands that access the data carriers are available for each system.

- The occasional execution system is automatically used, when commands only address the control interface unit without accessing a data carrier.

- The type of the communication startup system is set by writing one byte to the $A008_h$ address of the control interface unit's system memory:

Value	Explanation	Active trigger inputs
0	Occasional execution system (basic setting)	no
1	Command stay system	yes
2	Command register system	yes
3	Read/write head scan system	no

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Application

Occasional execution system:

- The MVI-D2-2HRX immediately executes a command.

- Used, when the host controller detects the presence of a data carrier:

  1. Started, by connecting the proximity switch to the host controller.

  2. Data carrier identification time: endless. Starts, when a data carrier is detected.

  3. An operator judges the existence of a data carrier and starts the command, for instance, by striking a key.

Command stay system:

- When the MVI-D2-2HRX detects the existence of a data carrier by means of a proximity switch which is connected to a trigger input, the MVI-D2-2HRX executes the current command and returns the result to the host controller.

- After completion of the command stay system operation, the MVI-D2-2HRX is ready for operation in the occasional execution system (available for simultaneous multiple operations).

- Used, when existence of a data carrier can be detected e.g. by a proximity switch and when the command has already been registered prior to the detection.

- Differences from the command register system:

  1. Commands can be easily changed by the host controller's program.

  2. Commands are purged after each operation.

  3. The host controller has to send a new command after each operation.

  4. Different modes of operation are available for each trigger input.

  5. The command stay system performs in a sensible manner, when the result influences the next command.

Command Register System:

- For each detection of a data carrier by means of the proximity switch which is connected to the trigger input. The MVI-D2-2HRX executes the command stored in the MVI-D2-2HRX and sends the result to the host controller.

- The command is stored to the MVI-D2-2HRX system memory.

- The command which is to be executed on activation of the trigger input, has been stored to the system memory in advance.

- Other stored commands are available until the trigger input is switched off (available for simultaneous multiple operations).

- Used, when existence of a data carrier can be detected, for instance by means of a proximity switch and when all transmission processes with the data carrier have already been registered.

- Simple installation, because on-site connection of the proximity switch to the MVI-D2-2HRX is possible.

- Differences from the command stay system:

  1. The command does not disappear when the MVI-D2-2HRX is battery-buffered. This means that it is not necessary to send a command to the control interface unit at the end of each operation.

  2. Commands are changed by altering the register content of the MVI-D2-2HRX.

  3. During an individual operation, the host contoller can concentrate on receiving a response from the MVI-D2-2HRX, enabling the host controller to perform less tasks.

Read/Write Head Scan System:

The read/write scan system supports commands which address individual read/write heads, as well as scan commands for all connected control interface units and read/write heads.

7.1.2 Response Return System

Two systems, the auto response system and the response request system are available for response from the MVI-D2-2HRX to the host controller.

- The system type is set by writing one byte to the $A00A_h$ address of the control interface unit's system memory:

Value	Command
0	Auto response system (basic setting)
1	Response request system

Auto response system

- After ending the transmission procedure, the MVI-D2-2HRX automatically returns the transmission result (end message) to the host controller.

- The end message timing cannot be determined by the host controller.

Application:

- Mainly used for configuration of a host controller and a MVI-D2-2HRX connection.

- Used for transmission configuration of the host controller and multiple MVI-D2-2HRX.

  In order to prevent collision of responses on transmission lines, it is better not to start the next command of another station, until the command of the currently transmitting station is completed.

Response request system

• After completion of the command, the MVI-D2-2HRX returns the transmission result (end message) to the host controller, in accordance with the request from the host contoller (hereafter referred to as "acknowledgement request").

• The host controller prescribes the timing for sending the end message.

Application:

• Mainly used for the configuration of a host controller and multiple MVI-D2-2HRX.

• Since the system returns the end message on request of the host controller, its processing time is longer than the auto response system's processing time.

7.2 Occasional Execution System

Unlike the command stay system and the command register system, the occasional execution system can start accessing the data carrier via the host controller, regardless of the MVI-D2-2HRX trigger input condition.

7.2.1 Occasional Execution System + Auto Response System

Transmission Procedure

1. The host controller sends commands to the MVI-D2-2HRX.

2. After receiving the commands, the MVI-D2-2HRX returns an acknowledgement to the host controller.

3. After the command has been executed, the MVI-D2-2HRX returns the end message to the host controller.

Transmission Sequence
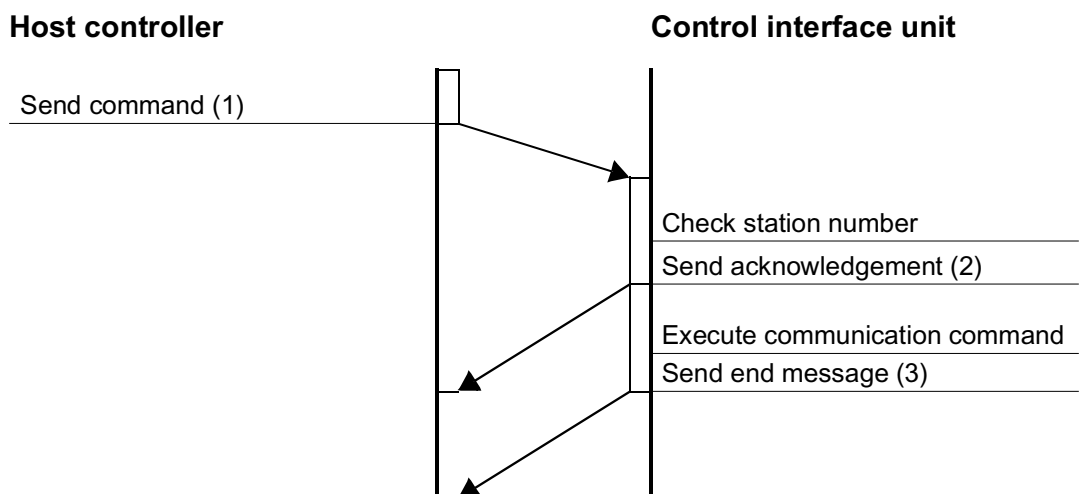
Host controller   **Control interface unit**

Send command (1)

Check station number

Send acknowledgement (2)

Execute communication command

Send end message (3)

Numbers (1) to (3) correspond to the above-mentioned transmission procedures.

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Communication Systems

Host controller operation flow

Numbers (1) to (3) correspond to the above-mentioned transmission procedures (see section 7.2.1).

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The following PC program was created in BASIC in order to read data:

```
100 'Read (Occasional Execution + Auto Response System)
110 CLS
120 OPEN "COM1:N71NN" AS#1
130 TX$="::00?10**000100004H@@"
140 PRINT #1, TX$
150 PRINT "Send command = ";TX$
160 INPUT #1, RT$(1)
170 PRINT "Acknowledgement= ";RT$(1)
180 IF MID$(RT$(1),5,1)<>"$" GOTO 210
190 INPUT # 1,RT$(2)
200 PRINT "End message = ";RT$(2)
210 CLOSE #1
```

7.2.2 Occasional Execution System + Response Request System

Transmission Procedure

1. The host controller sends commands to a specified MVI-D2-2HRX station.

2. The specified MVI-D2-2HRX station sends an acknowledgement to the host controller, as soon as it receives the command.

3. After receiving the acknowledgement, the host controller sends an acknowledgement request to the MVI-D2-2HRX.

4. When the specified MVI-D2-2HRX station receives the acknowledgement request after executing the command, it sends the end message to the host controller.

5. The host controller sends the acknowledgement request until the result returns from the specified MVI-D2-2HRX station. When the host controller sends an acknowledgement request during operation of the MVI-D2-2HRX, the latter returns an acknowledgement („#71").

Transmission Sequence
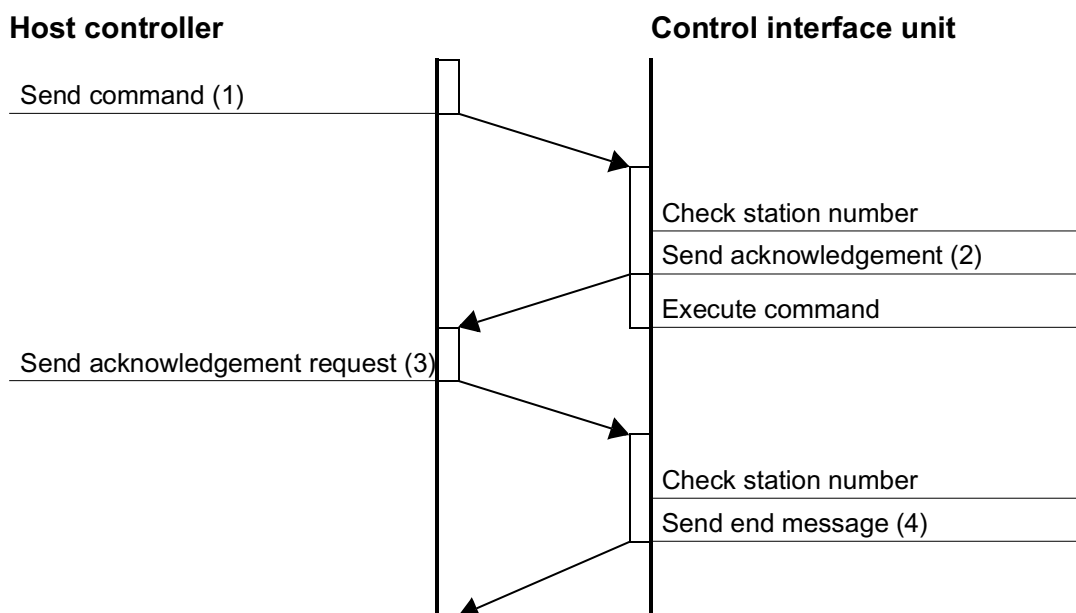
Numbers (1) to (4) correspond to the above-mentioned numbers of transmission procedures.

The following PC program was created in BASIC in order to read data:

```
100 ' Read (Occasional Execution + Response Request System)
110 CLS
120 OPEN"COM1:N71NN" AS#1
130 TX$(1)="::00?10**000100004H@@"
140 PRINT #1, TX$(1)
150 PRINT "Send command = ";TX$(1)
160 INPUT #1, RT$(1)
170 PRINT "Acknowledgement= ";RT$(1)
180 IF MID$(RT$(1),5,1)<>"$" GOTO 280
190 TX$(2)="::00?71@@ "
200 PRINT #1,TX$(2)
210 PRINT "Command acknowledgement request = ";TX$(2)
220 INPUT # 1,RT$(2)
230 IF MID$(RT$(2),5,1)<>"#" GOTO 270
240 IF MID$(RT$(2),6,2)<>"71" GOTO 270
250 PRINT "Message acknowledgement request = ";RT$(2)
260 GOTO 190
270 PRINT "End message = ";RT$(2)
280 CLOSE #1
```

Host controller operation flow

START

Send command (1)

no

Time out ← no ← Receive

yes

Normal response ($)/
error response (%)/
other response

Other response
than "$" or "%"

yes

OK ($)

error
(%)

Acknowledgement (2)

no

Receive

yes

Reset
processing

Other response
than "$" or "%"

Normal response ($)/
error response (%)/
other response

error
(%)

Error
response

OK ($)

End of transmission (4)

no

Reset
processing

Halt

yes

END

Acknowledge reception

End reception

Numbers (1) to (4) correspond to the
above-mentioned numbers of trans-
mission procedures.

7.3 Command Stay System

7.3.1 Command Stay System + Auto Response System

Transmission Procedure:

1. The host controller sends a command to the MVI-D2-2HRX.

2. After receiving the command, the MVI-D2-2HRX sends the acknowledgement to the host controller and stores the command.

3. The MVI-D2-2HRX trigger input is activated.

4. As long as the trigger input of the read/write head is ON, the MVI-D2-2HRX executes the command and sends the end message to the host controller.

It is possible to execute further commands in the occasional execution system (1→2→4) while the trigger input is active (ON).

Note: In case of commands without data carrier access, the system changes to the occasional execution system mode, regardless of the selected communication startup system.

Transmission Sequence

Host controller   Control interface unit

Send command (1)

Send acknowledgement (5)

ON signal at the trigger input (3)

Execute communication command

Send end message (4)

Send command (1)

While the trigger input is ON, commands can be executed as in the occasional execution system.

Send acknowledgement (2)

Execute communication command

Send end message (4)

Host controller operation flow

START

Send command (1)

no

Time out ◄ no Receive

yes

Normal response ($)/
error response (%)/
other response

Other response
than "$" or "%"

yes

OK ($)

error
(%)

Acknowledgement (2)

Acknowledge reception

no

Receive

yes

Reset
processing

Other response
than "$" or "%"

Normal response ($)/
error response (%)/
other response

error
(%)

Error
response

no

End reception

OK ($)

End of transmission (4)

Reset
processing

Halt

yes

END

Numbers (1) to (5) correspond to the
numbers of transmission procedures
already mentioned.

Date of issue   03.05.2001

The following PC program was created in BASIC in order to read data:

```
100 'Read (Command Stay + Auto Response System)
110 CLS
120 OPEN"COM1:N71NN" AS#1
130 TX$="::00?10**000100004H@@ "
140 PRINT #1, TX$
150 PRINT "Send command = ";TX$
160 INPUT #1, RT$(1)
170 PRINT "Acknowledgement= ";RT$(1)
180 IF MID$(RT$(1),5,1)<>"$" GOTO 220
190 PRINT "Wait for trigger input"
200 INPUT #1,RT$(2)
210 PRINT "End message = ";RT$(2)
220 CLOSE #1
```

7.3.2 Command Stay System + Response Request System

Transmission Procedure

1. The host controller sends a command to the MVI-D2-2HRX.

2. After receiving the command, the MVI-D2-2HRX sends the acknowledgement to the host controller and stores the command.

3. When the MVI-D2-2HRX trigger input is activated (ON), the MVI-D2-2HRX executes the stored command.

4. The host controller sends an acknowledgement request in order to inquire the result of a command.

5. After reception of the acknowledgement request, the MVI-D2-2HRX sends an end message to the host controller, when the command execution process is finished.

• The host controller sends acknowledgement requests until the result returns from the specified MVI-D2-2HRX station.

• The MVI-D2-2HRX has the option of executing commands in the occasional execution system while the trigger input is active (ON). (1)→(2)→(4)→(5)

Transmission Sequence

Host controller　　　　　　　　　　　**Control interface unit**

Send command (1)

Check station number

Send acknowledgement (2)

Send result request (4)

Trigger input ON (3) *)

Execute command

Check station number

Send end message (5)

Send command (1')

Check station number

Send end message (2)

Execute command

Commands can be
executed in the
occasional execution
system while the
trigger input is ON.

Send result request (4')

Check station number

Send end message (5')

*) When the command (1') is transmitted without sending a result request (4), the
MVI-D2-2HRX produces an "acknowledgement reception error" (EC69).

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Communication Systems

Host controller operation flow

Numbers (1) to (4) correspond to the above-mentioned numbers of transmission procedures.

```
Process acknowledgement

START
  │
  ▼
Send command (1) ◄──── no
  │
  ▼
Receive ──── no ──► Time out ──── no
  │                    │
 yes                  yes
  │                    │
  ▼                    ▼
Normal response ($)/  Reset
error response (%)/ ◄─ processing
other response
Other response than "$" or "%"
  │                              │
OK ($)                        Error (%)
  │
  ▼
Acknowledgement (2)
  │
  ▼
Send acknowledgement request (4) ◄── yes
  │
  ▼
Receive ──── no ──► Time out
  │
 yes
  │
  ▼
Normal response ($)/  ── Error (%) ──► Error response
error response (%)/
other response
Other response than "$" or "%"
  │
OK ($)
  │
  ▼
Operating ── yes
  │
 no
  │
  ▼
End of transmission (5)
  │
  ▼
Reset processing
  │
  ▼
Halt ── no
  │
 yes
  │
  ▼
END

Process receives end message
```

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The following PC program was created in BASIC in order to read data:

```
100 'Read (Command Stay + Response Request System)
110 CLS
120 OPEN"COM1:N71NN" AS#1
130 TX$(1)="::00? 10* *000100004H@@ "
140 PRINT #1, TX$(1)
150 PRINT "Send command = ";TX$(1)
160 INPUT #1, RT$(1)
170 PRINT "Acknowledgement= ";RT$(1)
180 IF MID$(RT$(1),5,1)<>"$" GOTO 290
190 PRINT " Wait for trigger input"
200 TX$(2)=":00?71@@"
210 PRINT #1,TX$(2)
220 PRINT "Command acknowledgement request = ";TX$(2)
230 INPUT #1,RT$(2)
240 IF MID$(RT$(2),5,1)<>"#" GOTO 280
250 IF MID$(RT$(2),6,2)<>"71" GOTO 280
260 PRINT "Response acknowledgement request = ";RT$(2)
270 GOTO 190
280 PRINT "End message = ";RT$(2)
290 CLOSE #1
```

7.4   Command Register System

- When the MVI-D2-2HRX receives a command to access the data carrier, the MVI-D2-2HRX stores this command in the system memory.

- Up to 8 transmission procedures can be stored for each read/write head. A storage location number from 1 to 8 is allocated to each command for transmission procedures.

- Each activation of a trigger input executes the stored function of the corresponding number, which has been allocated by means of the 75_h command.

- When the trigger input is activated, the system executes the transmission function of the stored number allocated by the host controller.

- The occasional execution system is used for storing a transmission procedure to the MVI-D2-2HRX system memory.

7.4.1 Command Register System + Auto Response System

Transmission Procedure

1. The host controller sends command 75_h to the MVI-D2-2HRX.
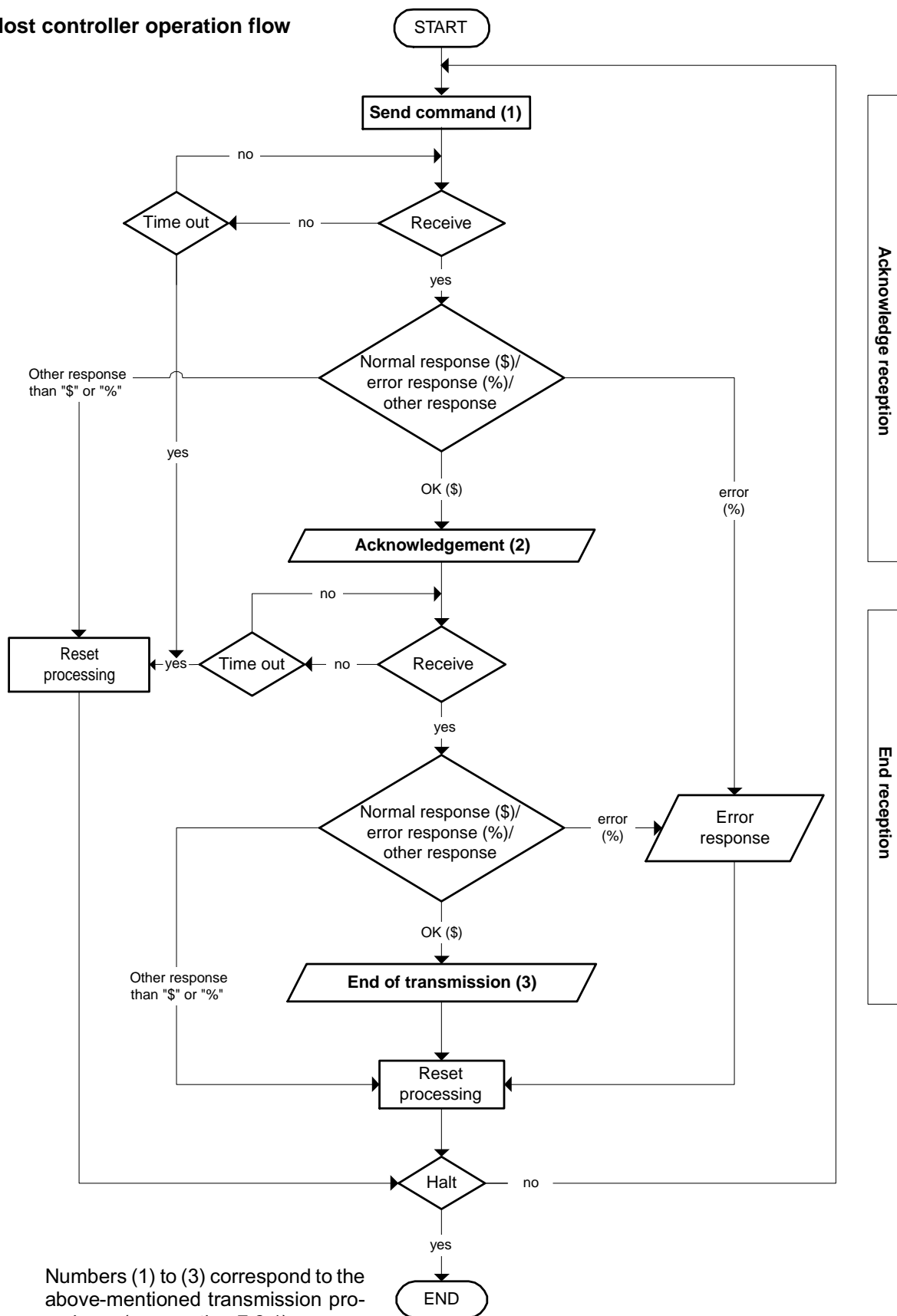
2. After receiving command 75_h, MVI-D2-2HRX sends an acknowledgement to the host controller. The stored process with the corresponding number allocated by command 75_h, is executed while the trigger input is active. (System memory of MVI-D2-2HRX: address 9010_h).

3. The MVI-D2-2HRX trigger input switches ON.

4. The MVI-D2-2HRX executes the transmission function of the corresponding storage number, allocated by command 75_h and sends the end message to the host controller.

5. With each activation of the trigger input, the transmission procedure, allocated by command 75_h, is executed (3)$\rightarrow$(4). The host controller can only wait for reception of the end message.

6. The next stored transmission function can be called by means of command 76_h while the trigger input is set.

- Send command 76_h. (2)$\rightarrow$(4)

- If the end message is incorrect during transmission between the host controller and the MVI-D2-2HRX, the host controller can send the command to the MVI-D2-2HRX for renewed execution (command 77_h). However, this function is available only while the trigger input is active.

- In order to stop transmission while the trigger input is active, the host controller sends a halt command (used when a MVI-D2-2HRX trigger input is active: address $9010_h = 0$). Although the trigger input is active, the transmission function is not executed.

- In order to change the transmission function, after setting the trigger input from OFF to ON, command 75_h must be sent.

Additional Description

- Command 75_h
  This command activates a stored transmission instruction, which is executed with a rising edge at the trigger input. This is required, in order to send a transmission procedure in case of a rising edge of a trigger input or a change of the transmission function.

- Command 76_h
  After the transmission procedure, instructed by command 75_h, has been executed, this command enables the data transmission of the next command to be activated, when the trigger input is in ON state. The command must be sent to the MVI-D2-2HRX for each transmission which is executed.

Transmission Sequence

Host controller	MVI-D2-2HRX

Send command for
trigger input ON (1)

Check station number

Send acknowledgement (2)

ON signal at the trigger input (3)

Execute stored command

Send end message (4)

Send next operation
start command (1')

Send acknowledgement (2')

Execute stored command

Send end message (4')

Send next operation
start command (1'')

Send acknowledgement (2'')

Execute stored command

Send end message (4'')

(B)

(A)
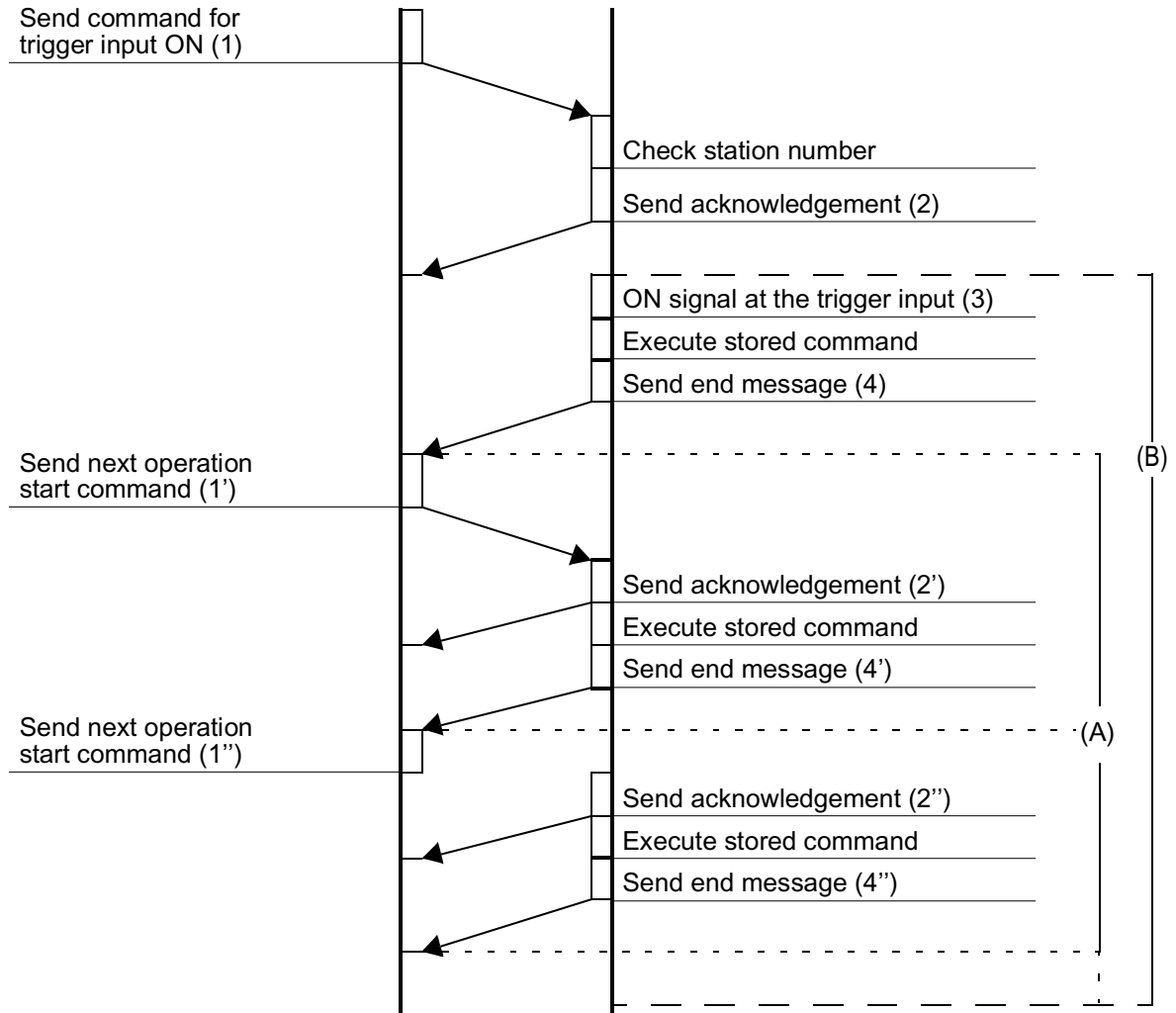
(A): Start next command, while trigger input is ON.
(B): Repeat at each turn ON of the trigger input.
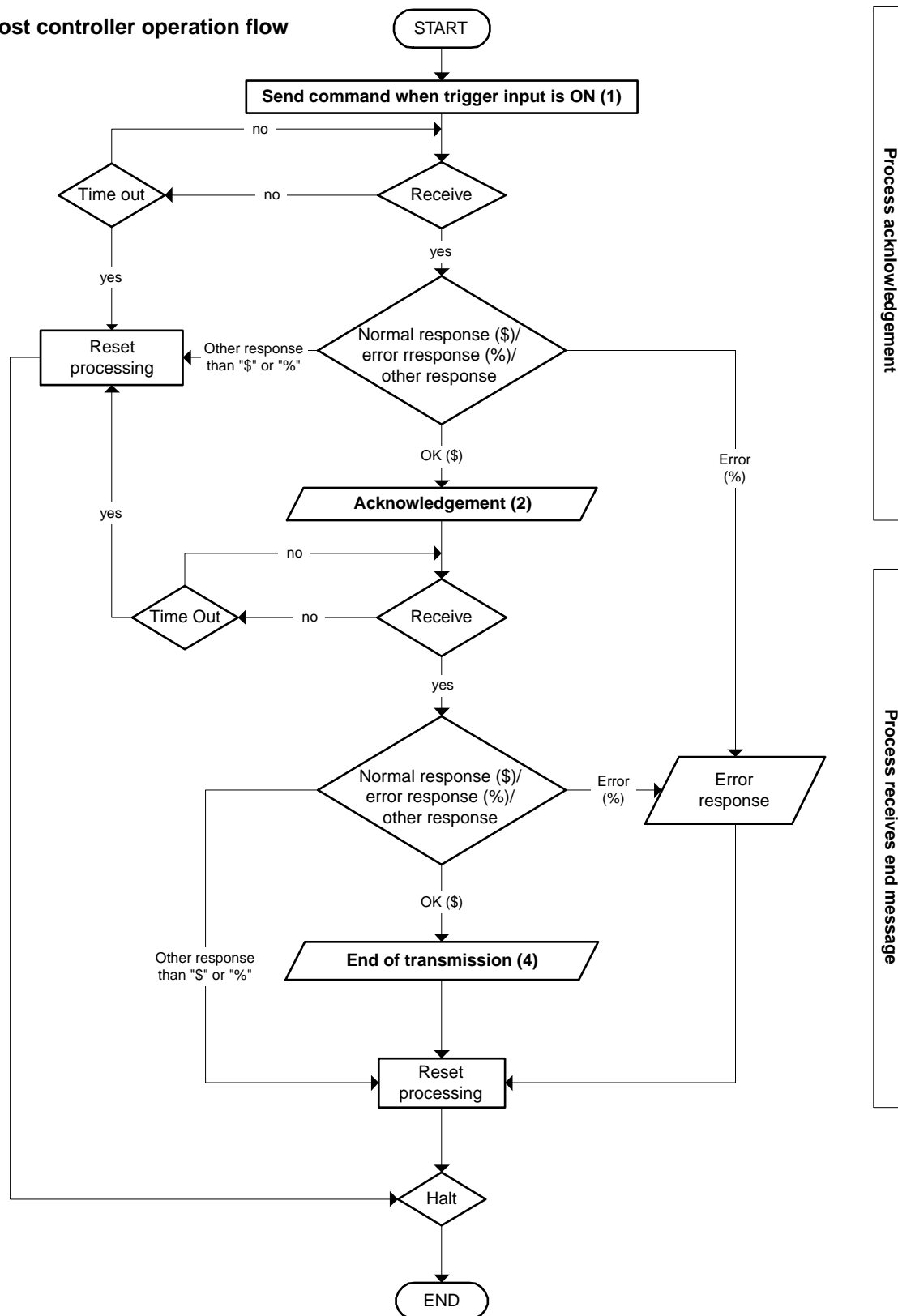
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Host controller operation flow

Numbers (1) to (4) correspond to the above-mentioned numbers of transmission procedures.

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The following PC programs, for storing and executing read data, were created in BASIC:

1. Storing read data:

```
100 'Read (Command Register + Auto Response System -
Registration)
110 CLS
120 OPEN "COM1:N71NN" AS#1
130 TX$="::00?102*000100004H@@"
140 PRINT #1, TX$
150 PRINT "Send command = ";TX$
160 INPUT #1, RT$(1)
170 PRINT "Acknowledgement = ";RT$(1)
180 IF MID$(RT$(1),5,1)<>"$" GOTO 210
190 INPUT #1,RT$(2)
200 PRINT "End message = ";RT$(1)
210 CLOSE # 1
```

2. Executing read data:

```
100 'Read (Command Register + Auto Response System - Instruction
Execution)
110 CLS
120 OPEN"COM1:N71NN" AS#1
130 TX$="::00?752@@ "
140 PRINT #1, TX$
150 PRINT "Send command = ";TX$
160 INPUT #1, RT$(1)
170 PRINT "Acknowledgement = ";RT$(1)
180 IF MID$(RT$(1),5,1)<>"$" GOTO 230
190 PRINT "Wait for trigger input"
200 INPUT #1,RT$(2)
210 PRINT "End message = ";RT$(2)
220 IF MID$(RT$(2),5,1)="#" GOTO 190
230 CLOSE # 1
```

7.4.2 Command Register System + Response Request System

Transmission Procedure

1. The host controller sends the command to start the function to the MVI-D2-2HRX.

2. After receiving command 75_h, the MVI-D2-2HRX returns an acknowledgement to the host controller (the registration number of the function, allocated by command 75_h, is executed while the trigger input is active; MVI-D2-2HRX system memory: address 9010_h).

3. When the trigger input of the MVI-D2-2HRX is active, the registered transmission function, allocated by command 75_h, is executed.

4. The host controller sends an acknowledgement request to the MVI-D2-2HRX, in order to inquire the result of the operation.

5. After reception of the acknowledgement request, the MVI-D2-2HRX sends an end message to the host controller, when the transmission procedure is finished.

6. The transmission function, allocated by command 75_h, is executed $(3) \rightarrow (4) \rightarrow (5)$ whenever the trigger input is ON.

7. The transmission function, allocated by command 76_h, is available $(2) \rightarrow (4) \rightarrow (5)$ while the trigger input is ON.

- Command 75_h is sent, in order to change the transmission function, when the trigger input is set from OFF to ON.

- When the end message is incorrect during transmission between the host controller and the MVI-D2-2HRX, the host controller sends the command to the MVI-D2-2HRX for renewed execution.

- In order to stop transmission, while the trigger input is active, the host controller sends a halt command. (Used when a trigger input of a MVI-D2-2HRX is active: address $9010_h = 0$).

- The storage process is not executed, even if the trigger input is ON.

Transmission Sequence

Host controller	MVI-D2-2HRX

Send command for
trigger input ON (1)

Check station number

Send acknowledgement (2)

ON signal at the trigger input (3)

Execute stored command
(stored by command (1))

Send result request (4)

Check station number

Send end message (5)

Send next operation start
command (1')

Send acknowledgement (2')

Execute stored command
(stored by command (1'))

Send result request (4')

Check station number

Send end message (5')

Send next operation start
command (1'')

Send acknowledgement (2'')

Execute stored command
(stored by command (1''))

Send result request (4'')

Check station number

Send end message (5'')

(B)

(A)

(A): A function can be started with the next command, while the trigger input is ON.

(B): Repetition with each switching of the trigger input from OFF to ON.

Numbers (1) to (5) correspond to the numbers of the transmission procedures on the previous page.
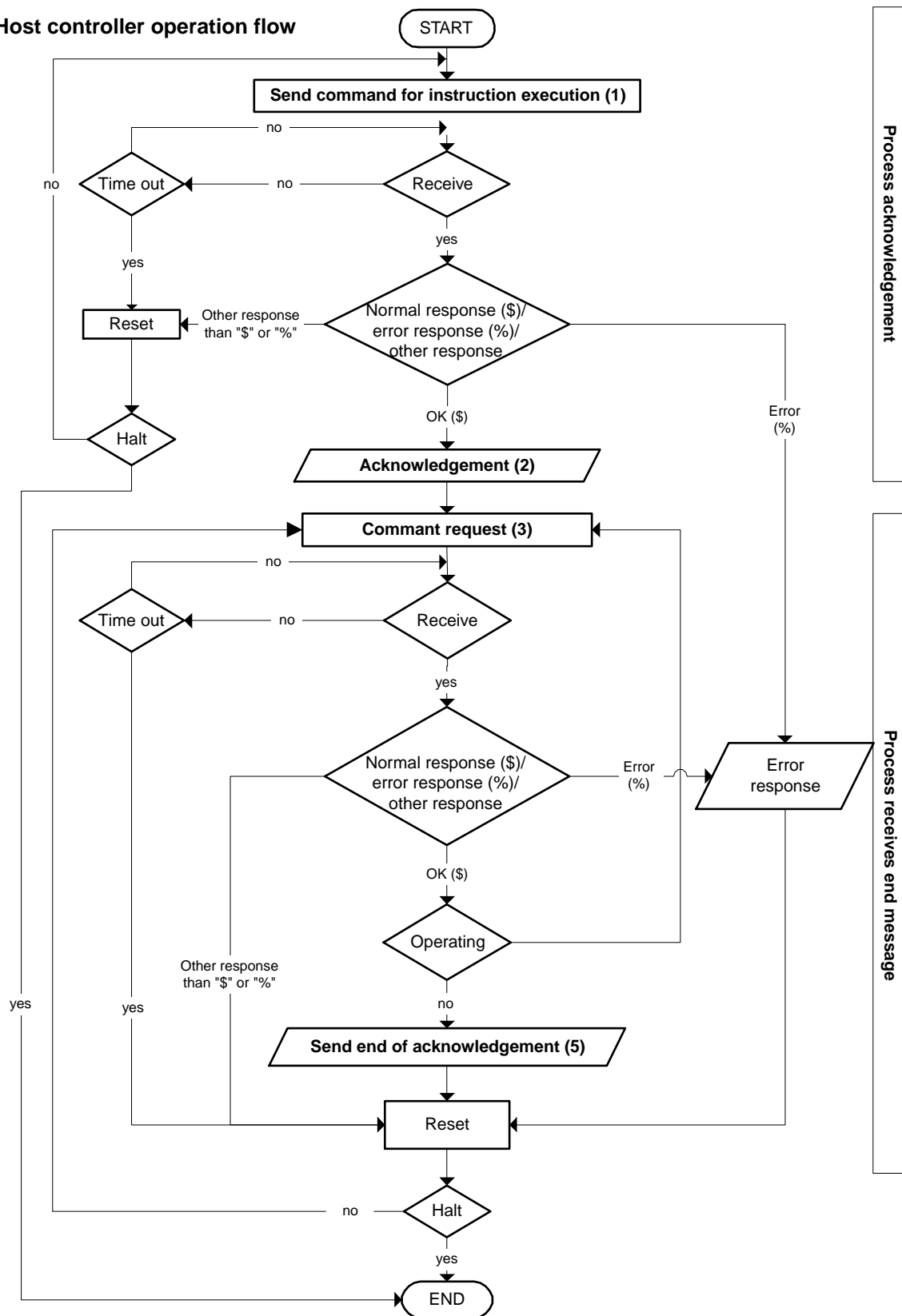
Host controller operation flow

```
                                    ┌─────────┐
                                    │  START  │
                                    └─────────┘
                                         │
        ┌────────────────────────────────▼────────────────┐
        │  Send command for instruction execution (1)      │
        └──────────────────────────────────────────────────┘
```

Process acknowledgement

```
            no
   ┌──────────────────────►
   │  Time out  ◄── no ──  Receive
   │     │                    │ yes
   │     │ yes                │
   │  ┌──────┐   Other response   ┌─── Normal response ($)/
   │  │Reset │ ◄── than "$" or "%" │    error response (%)/
   │  └──────┘                    │    other response
   │     │                              │ OK ($)        Error (%)
   │   Halt                    Acknowledgement (2)
```

Process receives end message

```
   Commant request (3)
            no
   ┌──────────────────────►
   │  Time out  ◄── no ──  Receive
   │                          │ yes
   │              Normal response ($)/    Error (%)   Error response
   │              error response (%)/
   │              other response
   │     Other response      │ OK ($)
   │     than "$" or "%"   Operating
   │                          │ no
   │              Send end of acknowledgement (5)
   │                          │
   │                        Reset
   │                          │
   │            no          Halt
   │                          │ yes
   │                         END
```

Numbers (1) to (5) correspond to the numbers of transmission procedures already mentioned.

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The following PC programs, for storing and executing read data, were created in BASIC:

1. Reading data:

```
100 'Read (Command Register + Response Request System -
    Command Registration)
110 CLS
120 OPEN "COM1:N71NN" AS#1
130 TX$(1)="::00? 102*000100004H@@"
140 PRINT #1, TX$(1)
150 PRINT "Send command = ";TX$(1)
160 INPUT #1, RT$(1)
170 PRINT "Acknowledgement = ";RT$(1)
180 IF MID$(RT$(1),5,1)<>"$" GOTO 280
190 TX$(2)="::00?71@@"
200 PRINT #1, TX$(2)
210 PRINT "Command acknowledgement request = ";TX$(2)
220 INPUT #1,RT$(2)
230 IF MID$(RT$(2),5,1)<>"#" GOTO 270
240 IF MID$(RT$(2),6,2)<>"71" GOTO 270
250 PRINT "Message acknowledgement request = ";RT$(2)
260 GOTO 190
270 PRINT "End message= ";RT$(2)
280 CLOSE #1
```

2. Executing read data:

```
100 'Read (Command Register + Response Request System -
    Instruction Execution)
110 CLS
120 OPEN "COM1:N71NN" AS#1
130 TX$(1)="::00?752@@"
140 PRINT #1, TX$(1)
150 PRINT "Send command = ";TX$(2)
160 INPUT #1, RT$(1)
170 PRINT "Acknowledgement = ";RT$(1)
180 IF MID$(RT$(1),5,1)<>"$" GOTO 300
190 PRINT " Waiting for trigger input"
200 TX$(2)="::00?71@@"
210 PRINT #1,TX$(2)
220 PRINT "Command acknowledgement request = ";TX$(2)
230 INPUT #1,RT$(2)
240 IF MID$(RT$(2),5,1)<>"#" GOTO 280
250 IF MID$(RT$(2),6,2)<>"71" GOTO 280
260 PRINT "Message acknowledgement request = ";RT$(2)
270 GOTO 190
280 PRINT "End message = ";RT$(2)
290 GOTO 190
300 CLOSE # 1
```

7.5 Read/Write Head Scan System

The read/write head scan system supports commands for individual read/write heads just as it successively performs the same operation for multiple read/write heads and MVI-D2-2HRX control interface units.

- The system successively sends one token to the connected MVI-D2-2HRX control interface unit. When a MVI-D2-2HRX has executed the desired command, it sends an end message.

- When a MVI-D2-2HRX does not receive a response from a data carrier within a specific time, regarding the microwave transmission, a message is sent to the next MVI-D2-2HRX.

- The host controller waits for an end message, when it sends a command "read/write head scan" to a MVI-D2-2HRX.

- The host controller controls the transfer time of the entire system.

- The read/write head scan system is the only system available as communication startup system. (When attempting to perform the communication startup system with other systems, an error is reported within the MVI-D2-2HRX).

- Response system: The auto response system as well as the response request system are available.

Connection conditions:

- Be sure to connect the host controller to a MVI-D2-2HRX with station number "0".

- Write the highest station number of the connected MVI-D2-2HRXs to the system memory of the MVI-D2-2HRX number "0" (address $A00B_h$, one byte). Note: When the value for the last station is set to "0", then the system works with only one MVI-D2-2HRX.

Setting the last station to "0":

- Use this value in case of a connection between the host controller and a MVI-D2-2HRX.

- Set the station number (SW3) of the MVI-D2-2HRX to "0".

- Operation: The number "0" control interface unit, keeps repeating the transmission procedure until one of the two read/write heads communicates with the data carrier.

- When using only one control interface unit, the RS 232C as well as the RS 422 interface standards are available via the corresponding terminal block and connector. In case of multiple control interface units, the RS 422 interface should be used.

Commands available for the read/write head scan system:	
Read:	Read (10_h), read and check (11_h), read the ID-code (12_h), read data carrier to the MVI-D2-2HRX (13_h), read and check the data carrier to the MVI-D2-2HRX (14_h)
Write:	Write (20_h), write and check (21_h), write ID-code (22_h)
Clear:	Clear (30_h), initialise data carrier (31_h)
Diagnosis:	Self-diagnosis of data carrier (50_h), ROM check (51_h), RAM check (52_h), check battery life of data carrier (53_h), block check (60_h)

The numbers in brackets denote the command code.

7.5.1 Read/Write Head System + Auto Response System

(between the host controller and the MVI-D2-2HRX with station number "0")

Transmission Procedure

1. The host controller sends a "read/write head scan" command to the MVI-D2-2HRX with station number "0".

2. After receiving the command "read/write head scan", the MVI-D2-2HRX number "0" sends an acknowledgement to the host controller.

3. After having received the acknowledgement, the host controller waits for the end message.

4. The MVI-D2-2HRX executes the function "read/write head scan" for all read/write heads from station number "0" to the last station number.

5. When the MVI-D2-2HRX has completed the transmission procedure with the data carriers, station number "0" sends the end message including the MVI-D2-2HRX station number and the number of the read/write head, which had executed the function, to the host controller.

- Each MVI-D2-2HRX executes transmission functions from read/write head number "0" to read/write head number "1".

- The token is sent to the next MVI-D2-2HRX, provided that there was no data carrier error, no read/write head error and no MVI-D2-2HRX error.

- In addition to the read/write head scan mode, the host controller can send other communication commands to any control interface unit.

Note:

- Station number "0" is required for transmission to the host controller (e.g. personal computer) as well as to the MVI-D2-2HRX.

- The read/write head scan procedure starts with the station number following the previous operation as well as the read/write head number of the previous operation.

Ex. 1: When the scanning ends with station number "1", and read/write head number "1" executes the last operation, the operation is restarted with station number "2" and read/write head number "0".

Ex. 2: When the scanning ends with station number "1", and read/write head number "0" executes the last operation, the operation is restarted with station number "1" and read/write head number "1".

Transmission Sequence

Host controller   **MVI-D2-2HRX of station number "0"**

Send command (1)

Check station number
(station number "0")

Send acknowledgement (2)

Send token of the transmission from
station number "0" to "N".

End of transmission procedure with the
data carrier

Send end message (5) (including the
station number and the read/write head
numbers of the closed function and the
data carrier)

Host controller operation flow

START

Emit sending (for read/write head scan) (1)

no

Time out ← no ← Receive

yes

Normal response ($)/
error response (%)/
other response

Other response
than "$" or "%"

yes

OK ($)

Error
(%)

Acknowledgement (2)

no

Reset ← yes ← Time out ← no ← Receive

yes

Normal response ($)/
error response (%)/
other response

Error
(%)

Error
response

OK ($)

Operating

Other response
than "$" or "%"

no

Send end of acknowledgement (5)

Reset

Halt ── no

yes

END

Processing of the acknowledgement

Processing of the acknowledgement

Numbers (1) to (5) correspond to
the numbers of transmission proce-
dures already mentioned.

The following PC program was created in BASIC in order to read data:

```
100 'Read (Read/Write Head Scan + Auto Response System)
110 CLS
120 OPEN"COM1:N71NN" AS#1
130 TX$="::0*?10**000100004H@@ "
140 PRINT #1, TX$
150 PRINT "Send command = ";TX$
160 INPUT #1, RT$(1)
170 PRINT "Acknowledgement = ";RT$(1)
180 IF MID$(RT$(1),5,1)<>"$" GOTO 220
190 PRINT "While scanning (wait for reception of end message)"
200 INPUT #1,RT$(2)
210 PRINT "End message = ";RT$(2)
220 CLOSE #1
```

7.5.2 Read/Write Head System + Response Request System

Transmission Procedure

1. The host controller sends a "read/write head scan" command to the MVI-D2-2HRX number "0".

2. After receiving the command "read/write head scan", station number "0" sends an acknowledgement to the host controller.

3. The MVI-D2-2HRX excutes the function "read/write head scan" for all read/write heads from station number "0" to the last station number.

4. After receiving the acknowledgement, the host controller sends a result request to station number "0".

5. After receiving the function request from the host controller, the MVI-D2-2HRx sends the end message including the MVI-D2-2HRX station number and the number of the read/write head, which has executed the function, to station number "0".

• The host controller keeps sending acknowledgement requests until the result returns from station number "0".

• Each MVI-D2-2HRX executes transmission functions from read/write head number "0" to read/write head number "1".

• The token is sent to MVI-D2-2HRX, provided that there was no data carrier error, no read/write head error and no MVI-D2-2HRX error.

• Further transmission procedures with the MVI-D2-2HRX (station number "n"), which executes the transmission function via read/write head scan, are available to the host controller.

Note:

• Station number "0" is required for the transmission to the host controller and to the MVI-D2-2HRX.

• The read/write head scan procedure starts with the next station number and the next read/write head number of the last operation.

Ex. 1: When the scanning ends with station number "1", and read/write head number "1" executes the last operation, the operation is restarted with station number "2" and read/write head number "0".

Ex. 2: When the scanning ends with station number "1", and read/write head number "0" executes the last operation, the operation is restarted with station number "1" and read/write head number "1".

Host controller		**MVI-D2-2HRX**
Send command (1)		
		Check station number (station number "0")
		Send acknowledgement (2)
		Send token of the transmission from station number "0" to "n".
		End of transmission procedure with the data carrier
Send command (1)		
		Check station number (#0)
		Send end message (5) (including the station number, and the read/write head numbers of the closed function and the data carrier)
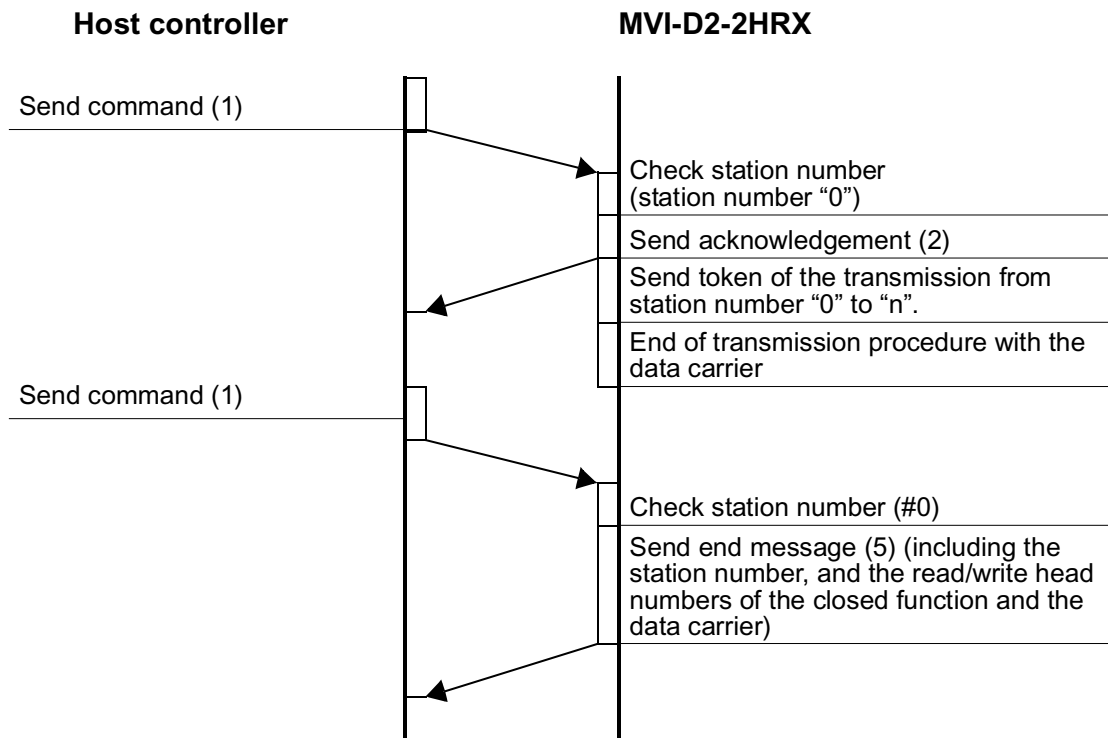
Numbers (1) to (5) correspond to the number of the transmission procedure on the previous page.
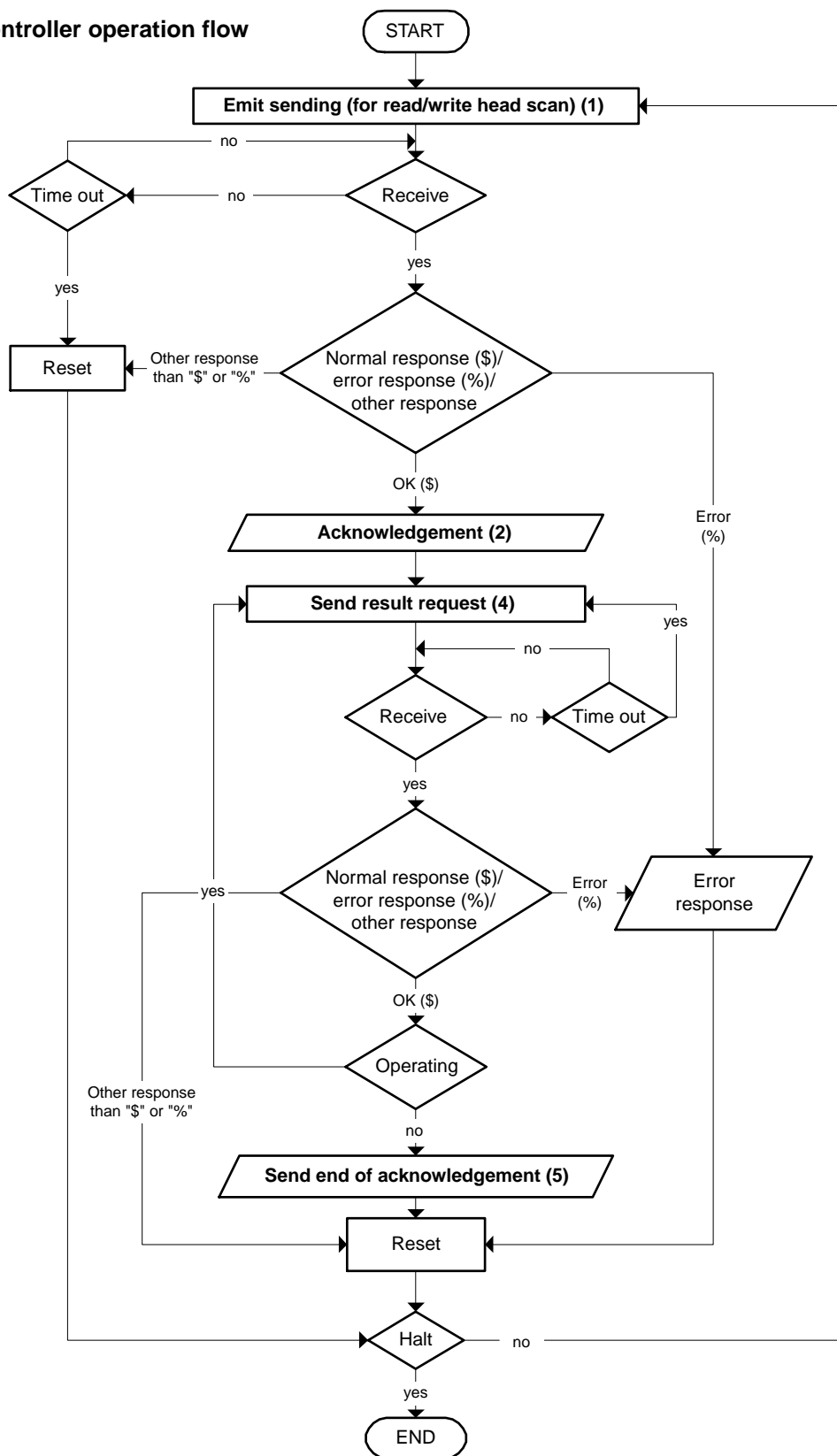
Host controller operation flow

Numbers (1) to (5) correspond to the numbers of transmission procedures already mentioned.

The following PC program was created in BASIC in order to read data:

```
100 'Read (Read/Write Head Scan + Response Request System)
110 CLS
120 OPEN "COM1:N71NN" AS#1
130 TX$(1)="::0*?10**000100004H@@"
140 PRINT #1, TX$(1)
150 PRINT "Send command = ";TX$(1)
160 INPUT #1, RT$(1)
170 PRINT "Acknowledgement = ";RT$(1)
180 IF MID$(RT$(1),5,1)<>"$" GOTO 290
190 PRINT "While scanning (wait for reception of end message)"
200 TX$(2)="::0*?71@@"
210 PRINT #1,TX$(2)
220 PRINT "Command acknowledgement request = ";TX$(2)
230 INPUT #1,RT$(2)
240 IF MID$(RT$(2),5,1)<>"#" GOTO 280
250 IF MID$(RT$(2),6,2)<>"71" GOTO 280
260 PRINT "Message acknowledgement request = ";RT$(2)
270 GOTO 190
280 PRINT "End message = ";RT$(2)
290 CLOSE #1
```

7.5.3 Connection Example

Connection of a host controller to an MVI-D2-2HRX connector with RS 232C. Adjusting the MVI-D2-2HRX switches: SW1-5 to OFF, SW1-6 to OFF, and SW1-7 to OFF.

MVI-D2-2HRX number "0"

RS 232C

Host controller
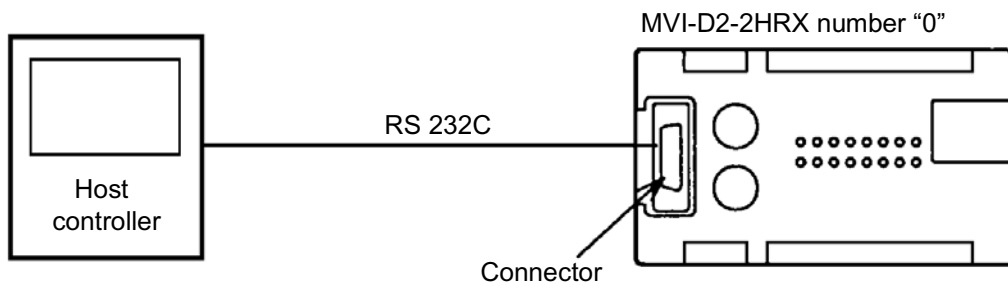
Connector

In case the last station number is higher than "0":

The host controller provides a one-to-one connection to MVI-D2-2HRX station number "0", and scans between multiple MVI-D2-2HRXs.

Connection

1. Connect the host controller to an RS 422 connector of the MVI-D2-2HRX station number "0".

2. Connect each output in parallel via an RS 422, between multiple MVI-D2-2HRX.

3. The MVI-D2-2HRX station number "0" is used as host controller among the connected MVI-D2-2HRX.

Switch Setting

Only the following switch settings are available:

SW1-5: set to OFF at all stations (type of connection: personal computer with serial interface).

SW1-6: OFF and SW1-7: ON for RS 422 connection (2-wire system), SW1-6 to ON and SW1-7 to OFF for RS 422 connection (4-wire system).

Connection Diagram
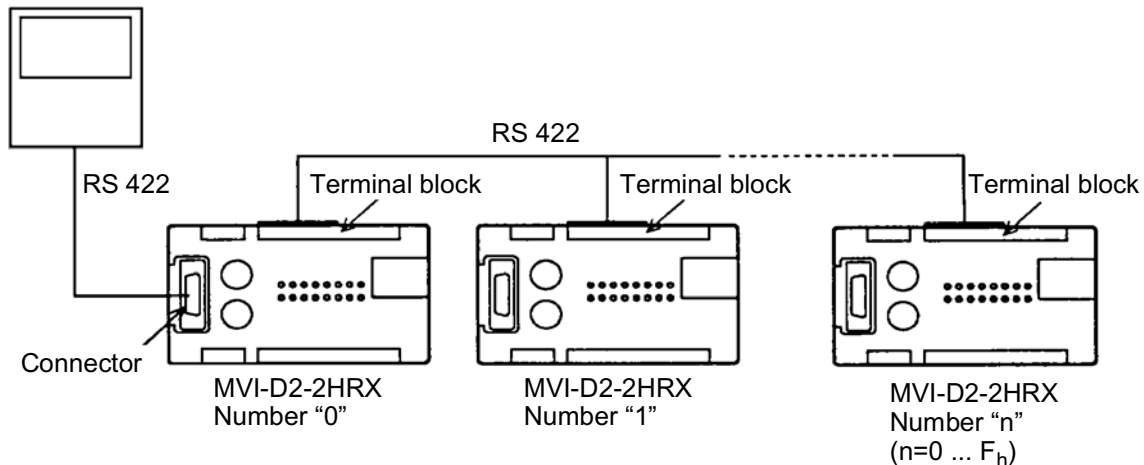
Transmission Specification

1. Between the host controller and the MVI-D2-2HRX with station number "0": Adjust switch SW1-1 to SW1-4 and SW2.

2. MVI-D2-2HRX (station number "0")
   Terminal block connection: 19200 baud, 8 data bit, odd parity, one stop bit (fixed setting). Note: Automatically set in the MVI-D2-2HRX (adjustment does not have to be reset).

3. From the MVI-D2-2HRX (next station after station number "0") to the last MVI-D2-2HRX station (between MVI-D2-2HRX control interface units):
   Terminal block connection: 19200 baud, 8 data bit, odd parity, one stop bit (fixed setting). Note: Automatically set in the MVI-D2-2HRX.

Transmission Specification	Switch	Setting
8 Data bits	SW1-1	ON
Odd parity	SW1-2 SW1-3	ON ON
Stop bit as 1	SW1-4	OFF
19200 bps	SW2	6

Operation

1. When MVI-D2-2HRX on station number "0" cannot receive a message from the data carrier after a certain number of repetitions, MVI-D2-2HRX number "0" transmits a token to the next and the following stations.

2. When the last MVI-D2-2HRX station cannot receive a message from the data carrier, the last station transmits a token to station number "0".

3. When an MVI-D2-2HRX successfully transmits data to a data carrier, MVI-D2-2HRX station number "0" returns an end message to the host controller.

Note:

As soon as the operation is completed, the next scanning starts with the next station and the next read/write head.

7.6 Simultaneous Processing of Commands

7.6.1 With One Read/Write Head

When the MVI-D2-2HRX receives the second command before sending the end message for the first command, two commands are processed in one read/write head and an error message (error at command execution) is sent in response to the second command.

Note: Based on the error code, the host controller identifies to which commands the error messages belong. The host controller is able to distinguish unambiguously between the error code, generated by executing the first command, and the error code of the second command. (Error at executing a command).

The MVI-D2-2HRX does not cancel the first command and executes the transmission procedure. Then the following acknowledgement is sent:

1. Auto response system: Return end message during a process such as a data carrier access.

2. Response request system: After a process, such as a data carrier access has been accomplished, the end message is returned after receiving the result request.

This applies to both the occasional execution system and the command stay system.

IDENT-M System V
Communication Systems

Auto Response System:

Host controller	**MVI-D2-2HRX**

Send command (1)

Send acknowledgement for command (1)

Send command (2)

Send error message for command (2)

Send end message command (1)

Response Request System:

Host controller	**MVI-D2-2HRX**

Send command (1)

Send acknowledgement for command (1)

Send command (2)

Send error message for command (2)

Send result request (1)

Send end message of command (1)

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7.6.2 With Two Different Read/Write Heads

When two read/write heads are connected to the MVI-D2-2HRX, the host can send a command to one channel while the other channel provides communication between the read/write head and the data carrier.

Transmission Sequence with Auto Response System:

Host controller   **MVI-D2-2HRX**

Send command (1)
(Read/write head 0)

Send acknowledgement (2)
(Read/write head 0)

Microwave transmission
between read/write head 0
and data carrier

Send command (1')
(Read/write head 1)

Send acknowledgement (2')
(Read/write head 1)

Simul-
taneous

Send end message (3)
(Read/write head 0)

Microwave transmission
between read/write head
1 and data carrier

Send end message (3)
(Read/write head 1)

Transmission Sequence of the Response Request System:

Host controller   **MVI-D2-2HRX**

Send command (1)
(Read/write head 0)

Send acknowledgement (2)
(Read/write head 0)

Microwave transmission
between read/write head 0
and data carrier

Send command (1')
(Read/write head 1)

Send acknowledgement (2')
(Read/write head 1)

Send result request
(Read/write head 0)

Simul-
taneous

Send end message (3)
(Read/write head 0)

Send result request
(Read/write head 1)

Microwave transmission
between read/write head 1 and
data carrier

Send end message (3)
(Read/write head 1)

7.6.3 Description

- When the microwave communication of read/write head 0 and read/write head 1 is doubled, the MVI-D2-2HRX performs simultaneous processing for both read/write heads.

- Each response return system has a different end message.

  1. Auto response system: Acknowledgement from the first channel, that has completed the microwave transmission.

  2. Response request system: The first channel to receive an acknowledgement request returns an acknowledgement after executing the microwave transmission.

- Since the commands, acknowledgements, result requests and end messages have a read/write head number, the host controller is able to identify the read/write head number.

- Make sure that the command for the second read/write head is not transmitted until the acknowledgement for the first read/write head has been received and vice versa. When the acknowledgement of one channel collides with the command of another channel, the MVI-D2-2HRX can neither receive the command (command (1) of read/write head 1) nor execute the function.

8 Transmission Procedure

8.1 Overview

Two types of transmission functions can be distinguished: "Communication with data carrier", such as transmission between the host and the data carriers, as well as between MVI-D2-2HRX control interface units and data carriers; and "MVI-D2-2HRX access function", which represents transmission between the host controller and the MVI-D2-2HRX.

The MVI-D2-2HRX has a data carrier buffer for each read/write head which is in the same memory area as the data carriers are. (The MVI-D2-2HRX has the same address structure as the data carrier.)

The command register system allows only commands that access data carriers to be stored as transmission procedure. Commands which only access the control interface unit, cannot be stored in the command register system.

Transmission procedure		Command code (Hex.)	Data transm. direction	Classifi-cation[1]	Description
Read	Read	1 0	(-1)	P	Read in data carrier data to the host controller
	Read and check	1 1	(-1)	P	Read data carrier twice. The data is transmitted to the host controller, after checking the first and the second data.
	Read ID code	1 2	(-1)	P	Read in ID code of the data carrier to the host controller (data carrier address: 8040_h to 8043_h).
	Read in data carrier to the MVI-D2-2HRX	1 3	(-3)	P	Read in data of data carrier to MVI-D2-2HRX data carrier buffer.
	Read and check data from data carrier to MVI-D2-2HRX	1 4	(-3)	P	Read data carrier twice. The data is stored in the MVI-D2-2HRX data carrier buffer, after the first and the second data is checked.
	Read MVI-D2-2HRX	1 5	(-5)	C	Send MVI-D2-2HRX data from the data carrier memory to the host controller.
	Read current time	1 6	(-5)	C	Read current time (year, month, week-day, hour, second) from the clock integrated in the MVI-D2-2HRX.

1) Shows the classification of the transmission procedure. Commands identified by the letter P access the data carriers. Commands identified by the letter C access the MVI-D2-2HRX.

Transmission procedure		Command code (Hex.)	Data transm. direction	Classifi-cation[1]	Description
Write	Write	2 0	(-2)	P	Write data from the host to the data carrier.
	Write and check	2 1	(-2)	P	The data is read and checked after writing it from the host controller to the data carriers. (Read-after-write system)
	Write with ID code	2 2	(-2)	P	Write ID code to data carriers (data carrier address: 8040_h to 8043_h)
	Write from MVI-D2-2HRX to data carrier	2 3	(-4)	P	Write the data stored in the MVI-D2-2HRX data carrier buffer to the data carriers.
	Write and check from the MVI-D2-2HRX to the data carriers	2 4	(-6)	C	The data, stored in the data carrier buffer of the MVI-D2-2HRX, is first written, then read and checked. (Read-after-write system)
	Write from host controller to MVI-D2-2HRX	2 5	(-6)	C	Store data from the host controller to the system memory and the data carrier buffer of the MVI-D2-2HRX.
	Set the current time	2 6	(-6)	C	Set right the time (year, month, week-day, hour, second) of the clock integrated in the MVI-D2-2HRX.
Clear	Clear	3 0	(-2)	P	Write the same data into a specified area of the data carrier.
	Initialisation of the data carrier	3 1	(-2)	P	Initialise data area of data carrier and system area.
	Clear MVI-D2-2HRX memory	3 5	(-6)	C	Write the same data into a specified area such as the data carrier buffer of the MVI-D2-2HRX.
	Initialisation of MVI-D2-2HRX	3 6	(-6)	C	Initialise data of data carrier buffer and system memory of MVI-D2-2HRX.
	Clear protocol (transmission time, number of transmission, error protocol)	3 7	(-6)	C	Clear transmission time, transmission number and error protocol of the MVI-D2-2HRX system area.
Copy	Copy with different read/write heads	4 0	(3)→(4)	P	Copy the data from a data carrier facing a read/write head to another data carrier facing the other read/write head.
	Copy and check using different read/write heads	4 1	(3)→(4)	P	Read data carrier facing a read/write head twice, check these two data, and copy them to the other read/write head, facing the opposite read/write head. Then read and check.

1) Shows the classification of the transmission procedure. Commands identified by the letter P access the data carriers. Commands identified by the letter C access the MVI-D2-2HRX.

Transmission procedure		Command code (Hex.)	Data transm. direction	Classifi- cation[1]	Description
Diagnostic	Self-diagnosis of data carriers	5 0	-	P	Diagnosis of ROM, RAM and battery life of data carrier.
	ROM check	5 1	-	P	Diagnosis of ROM in data carrier
	RAM check	5 2	-	P	Diagnosis of RAM in data carrier (area adjustable)
	Check battery life of data carrier	5 3	-	P	Diagnosis of battery life of data carrier (checks battery voltage and service life).
	Self-diagnosis of MVI-D2-2HRX	5 5	-	C	Diagnosis of ROM, RAM and battery life of MVI-D2-2HRX
	Block check	6 0	-	P	Check whether the data stored on the data carrier is correct, by using the block check code.
Other	Reset	7 0	-	C	• Stop the currently executed transmission procedure. • Reset error state of MVI-D2-2HRX.
	Request command response	7 1	-	C	If the response request system is applied, an acknowledgement request is transmitted to the MVI-D2-2HRX.
	Set outputs	7 2	-	C	Switch ON or OFF outputs 0 ... 3.
	Read status	7 3	-	C	Read MVI-D2-2HRX status.
	Stop command	7 4	-	C	• Instruction to stop transmission function stored in the MVI-D2-2HRX using the command register system. • Instruction to stop the read/write head scan function.
	Calling a registered command	7 5	-	C	[Command register system] Instruction to start the stored command, when the trigger input is set to ON (allocate storage number likewise).
	Calling the registered command	7 6	-	C	[Command register system] Instruction to start the function after ending the function triggered by the next command 75_h . Simultaneous execution of functions is possible. (Operating status: Trigger input remains active.)
	Repeat command	7 7	-	C	[Command register system] The host controller requests repeated execution of the previous command (e.g.: faulty transmission of end message).

1) Shows the classification of the transmission procedure. Commands identified by the letter P access the data carriers. Commands identified by the letter C access the MVI-D2-2HRX.

Date of issue 03.05.2001

8.1.1 Verification

When the two verified data differ, the MVI-D2-2HRX treats this as a verification error. The address of the differing data is included in the error message. If an error, e.g. a data transmission error occurs during "read and check", the end address of the write data is likewise attached to the error message.

8.1.2 Copy

The copy command reads data of a specified range of the data carrier which is facing the read/write head and writes them into the data carrier, which is facing the other read/write head. In order to accelerate data processing time, this function is executed in the MVI-D2-2HRX without data storage in the connected host controller.

1. Usable memory area of the data carrier

- Data area MVC-60-64K: 7552 bytes

- Data area MVC-60-256K: 31 kbyte

2. When instructing to copy data, enter the read/write head number from which the data should be read.

3. When ID code allocations are used, the ID code of the data carrier which has to be recorded, must be specified.

4. Applications

- When a workpiece reaches the end of the production line and is then placed on another pallet for the next process, the data should be copied from one data carrier to the data carrier of the next process, in order to keep current processing and information running.

- All data stored in the data carrier must be copied before the batteries are exhausted.

8.1.3 Block Check

This function checks whether the data of the data carrier have only changed due to write, clear and copy commands. This command divides the data area and the system area of the data carrier (see the following table) and checks all blocks from the start block to the following blocks for errors.

Example: This function checks block 1 and block 2, when $007F_h$ is set as starting address and the byte number is two byte. When any error is found in these blocks, the MVI-D2-2HRX treats this as a block check error.

			Address (hex.)
	Block 1	128 bytes	0000 007F
	Block 2	128 bytes	0080 00FF
Data area (7552 bytes)	. . .	128 bytes for each block	0100 . . . 1CFF
	Block 59	128 bytes	1D00 1D7F
System area (126 bytes)	Block 60	126 bytes	8040 807D
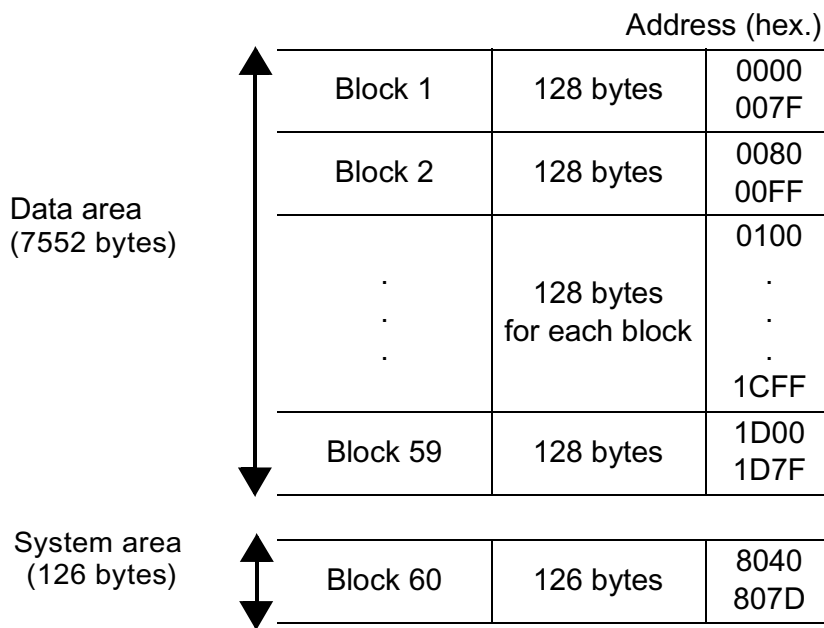
8.1.4 Self-Diagnosis of the Data Carrier

In normal operation the data carrier performs a self-diagnosis. The diagnosis is carried out in the following order: ROM check, RAM check and data carrier battery life check. These three checks are also available individually.

8.1.5 ROM Check

This check determines whether the ROM which controls the data carrier works trouble-free. When it has an error, the MVI-D2-2HRX treats this as a ROM error.

8.1.6 RAM Check

This function checks the RAM integrated in the data carrier within the assigned range. When an error is found, the MVI-D2-2HRX treats this as a RAM error. The start address and the error number are attached to the error message.

8.1.7 Checking the Battery Life of a Data Carrier

When an error occurs during the check, an error code indicating low battery voltage or a long service life is displayed. The battery or the data carrier have to be replaced. In order to rescue the contents of a data carrier, you have to save the memory contents of the data carrier by a normal copy command. The warning information (W + error position) for low battery voltage is inserted into the end message at the start of the checksum code even when the test is completed without any errors (see page 185).

8.1.8 Self-diagnosis of MVI-D2-2HRX

When an error occurs, the error code of the MVI-D2-2HRX error (ROM error/RAM error/warning low battery voltage) is indicated. For details on the warning function for low battery voltage see chapter 8.1.7 "Checking the Battery Life of a Data Carrier".

8.2 Output Instructions

The MVI-D2-2HRX has four outputs, from 0 to 3.

ON/OFF-specifications of the outputs

- Turn the outputs ON or OFF with the host controller's "output instruction".
- ON and OFF time is freely selectable.

8.2.1 Example for the Use of Output 0 for a Normal End

Transmission sequence (occasional execution system + auto response system).

Host controller	MVI-D2-2HRX

Send command

Send acknowledgement

Execute a function like a transfer to data carriers

Send end message ← **Normal end**

Send output instruction (command to set output 0 to ON)

Send acknowledgement

Set output 0 to ON

Send end message

Elapse of the time interval

Send output instruction (command to set output 0 to OFF)

Send acknowledgement

Set output 0 to OFF

Send end message

Transmission Sequence

(Occasional execution system + response request system)

Host controller

MVI-D2-2HRX

Send command

Send acknowledgement

Execute a function like a transfer to data carriers

← **Normal end**

Send acknowledgement

Send end message

Send output instruction
(command to set
output 0 to ON)

Send acknowledgement

Set output 0 to ON

Send acknowledgement

Send end message

Elapse of the time interval

Send output instruction
(command to set
output 0 to OFF)

Send acknowledgement

Set output 0 to OFF

Send acknowledgement

Send end message

8.2.2 Example for the Use of Output 1 as an Error Output

Transmission sequence (occasional execution system + auto response system).

Host controller   **MVI-D2-2HRX**

Send command

Send acknowledgement

Execute a function like a transfer to data carriers

Send error signal   ← **Error**

Send output instruction
(command to set
output 1 to ON)

Send acknowledgement

Set output 1 to ON

Send end message

Send reset command

Send acknowledgement

Reset error condition

Send end message

Send output instruction
(command to set
output 1 to OFF)

Send acknowledgement

Set output 1 to OFF

Send end message

Reset
the error

Transmission Sequence

(Occasional execution system + response request system)

Host controller		MVI-D2-2HRX

Send command

→ Send acknowledgement

Execute a function like a
transfer to data carriers → **Normal end**

Send acknowledgement

Send end message

Send output instruction
(command to set
output 0 to ON)

Send acknowledgement

Set output 1 to ON

Send acknowledgement

Send end message

Send reset command

Send acknowledgement

Reset error condition

Send acknowledgement

Send end message

Reset the
error

Send output instruction
(command to set
output 0 to OFF)

Send reception command

Set output 1 to OFF

Send acknowledgement

Send end message

Memory of the Data Carrier

Designation of memory area			Address			Number of bytes	Initial value$_h$	Write Clear[a]	Read[b]
			Hex. $_h$	Dec. $_d$	Octal $_8$				
(1) Data area			0 ... 1D7F	0 ... 7551	0 ... 16577	7552		available	available
System area	(10) Write-protected data area	(2) Free area		8000 ... 803F	32768 ... 32831	100000 ... 100077	64	00	
		(3) ID code		8040 ... 8043	32832 ... 32835	100100 ... 100103	4		
		(4) Data carrier prod. date	Month	8044	32836	100104	2	Set at production	not available
			Year	8045	32837	100105			
		(5) Number of transmission operations		8046 ... 8049	32838 ... 32841	100106 ... 100111	4		
		(6) Operation time 1 (LED does not light)		804A ... 804D	32842 ... 32845	100112 ... 100115	4		
		(7) Operation time 2 (LED lights)		804E ... 8051	32846 ... 32849	100116 ... 100121	4		
		(8) Reception off-time		8052 8053	32850 32851	100122 100123	2		
		(9) Setting the time when the LED lights.		8054	32852	100124	1		available
		System area protection		8055	32853	100125	1		
		#1	Start address	8056,7	32854,5	100126,7		00	available
			Number bytes	8058,9	32856,7	100130,1			
		#2	Start address	805A,B	32858,9	100132,3			
			Number bytes	805C,D	32860,1	100134,5			
		#3	Start address	805E,F	32862,3	100136,7			
			Number bytes	8060,1	32864,5	100140,1			
		#4	Start address	8062,3	32866,7	100142,3			
			Number bytes	8064,5	32868,9	100144,5			
		#5	Start address	8066,7	32870,1	100146,7			
			Number bytes	8068,9	32872,3	100150,1	40		
		#6	Start address	806A,B	32874,5	100152,3			
			Number bytes	806C,D	32876,7	100154,5			
		#7	Start address	806E,F	32878,9	100156,7			
			Number bytes	8070,1	32880,1	100160,1			
		#8	Start address	8072,3	32882,3	100162,3			
			Number bytes	8074,5	32884,5	100164,5			
		#9	Start address	8076,7	32886,7	100166,7			
			Number bytes	8078,9	32888,9	100170,1			
		#A	Start address	807A,B	32890,1	100172,3			
			Number bytes	807C,D	32892,3	100174,5			

a. "Reading", "writing" or "clearing" data values by the user program.
b. The copy command, in this case, is the same as "read" + "write".

Addresses 1D80$_h$ to 7FFF$_h$ and 807E$_h$ and after are blocked for transmission.

Memory Area Designations and their Functions and Contents:

1. Data area and

2. free area:
   Data area and free area store arbitrary data

3. ID code

Available values: 4.294.967.295

Hexadecimal: $FFFFFFF_h$

Decimal: 1 ... 4294967295_d

Octal: 1 ... 37777777777_8

Example: ID code 123456_8

Memory address		8043_h					8042_h					8041_h					8040_h	
	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 1	0 1	0 0	1 1	1 0	0 1	0 1	1 1	0	
ID code	0	0	0	0	0	**1**	**2**	**3**	**4**	**5**	**6**							

4. Production date of the data carrier
   The production month is encoded in BCD code 01 to 12. The production year is encoded in BCE code 00 to 99 without the first two digits of the year.

Production month of data carrier

Examples:

Produced in **September**   Produced in **December**

Memory address		8044_h		
	0 0 0 0 1 0 0 1			
Month	**0**	**9**		

Memory address		8044_h	
	0 0 0 1 0 0 1 0		
Month	**1**	**2**	

Production year of data carrier

Example:

Produced in 1993

Memory address		8045_h
	1 0 0 1 0 0 1 1	
Year	**9**	**3**

5. Number of transmission procedure
   Each command, that causes a communication between the read/write head and the data carrier, has the effect that the counter increments by one.
   0 to 4.294.967.295d (maximum number of communication procedures)

6. Accumulated operation time 1 (LED does not light)
    When the data carrier communicates with a read/write head, the data carrier changes into the active operating status. This value is the total of the active operation time. The value is between 1 and $4.294.967.295_d$ ms.

7. Accumulated operation time 2 (LED lights)
    This value equals the total period of time, in which the LED of the data carrier's activity light is illuminated. The value is between 1 and $4.294.967.295_d$ ms.

8. Reception off-time
    After communicaton of the data carrier with a read/write head, the data carrier does not accept further commands for the time that has been set. Set to 0 to 65535 seconds.

9. Set time, during which the LED lights
    Set the lighting time of the data carrier's LED between 0.2 and 25.5 seconds. The set values 2 to 255_d are equal to 0.2 to 25.5 seconds. Set the command for the LED to light in the memory address 9002_h (110002_8) of MVI-D2-2HRX.

10. Write protection
    This function is to protect data in the data carrier from being deleted inadvertently. Set write-protected area (memory address: 8055_h and after).

Item	Contents
Setting method	**Data area** Set start address and number of bytes for the write protection in the "write-protected area". Example: Set 1023 (1777_8) bytes from area address 12345_8 to 14343_8 on protection 1. Memory address 8057_h 8056_h 0 0 0 1 0 1 0 0 1 1 1 0 0 1 0 1 Start address 0 1 2 3 4 5 Memory address 8059_h 8058_h 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 Number of bytes 0 0 1 7 7 7
	System area Set contents of memory addresses 8055_h (100125_8) to FF_h.
Setting range	**Data area** MVC-60-64K: 0000...$1D7F_h$ (000000...016577_8)
	System area Whole area (except write protection adjustment range).
Setting positions	**Data area** Max. 10 positions (save areas 1 to A_h).
	System area 1 position (whole area).
Reset the setting	Set the respective position of the "write-protected area" to 0.

When the write-protected area receives commands such as "write", "clear" or "copy" the MVI-D2-2HRX returns the following information in the error signal:

- Protection error (error code 18_h).
- Start address of the write-protected area.

Note:

- Save areas 1 to 9 and A_h do not have to be set in the order of addresses in the data area (as shown in example 1).

- The write-protected area can be set by overlapping with other write-protection settings (as shown in example 2).

Example 1:
Save area 2 has a smaller address as save area 1
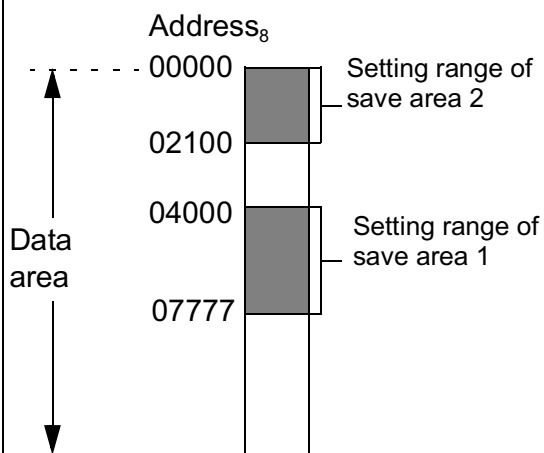
Example 2:
The setting range of the write protection is 00000_8 to 11777_8
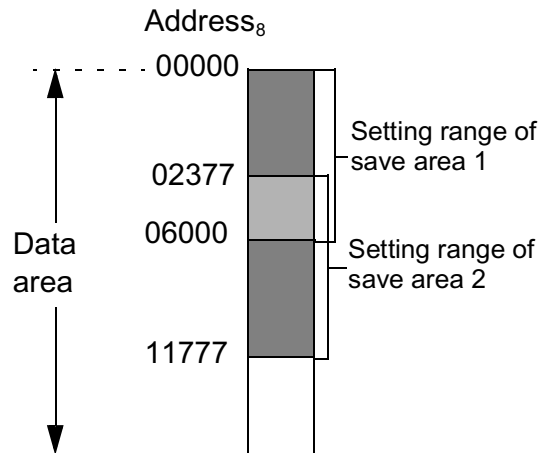
8.3 Memory of the Control Interface Unit

The MVI-D2-2HRX has both a data carrier buffer (data area and system area) and a system memory (data carrier transmission area and special area for the MVI-D2-2HRX).

Memory area designation			Address (hex.)	Number of bytes
Read/write head 0	Data carrier buffer	Data area	0000 ... 1D7F	7552
		System area	8000 ... 807D	126
	System memory (Data carrier transmission range)		9000 ... 9D81	3458
Read/write head 1	Data carrier buffer	Data area	0000 ... 1D7F	7552
		System area	8000 ... 807D	126
	System memory (Data carrier transmission range)		9000 ... 9D81	3458
System memory (specifically for MVI-D2-2HRX)			A000 ... A00B	12

- The contents of the data carrier buffer is the same as that of the data carrier memory.

- In order to set or change data, use the following commands: read MVI-D2-2HRX (15_h), write MVI-D2-2HRX (25_h), clear MVI-D2-2HRX (35_h), initialise MVI-D2-2HRX (36_h) and clear the protocol area (37_h).

System Memory (Data Carrier Transmission Range)

Memory area designation		Address (hex $_h$)	Number of bytes	Initial value (hex.)
(1) Recognition time		9000	1	00
(2) LED operation monitor	Data carrier LED ON	9002	1	
	Adjusting time for LED	9003	1	05
(3) Register of transmission function	Function at the trigger input is ON	9010	1	00
	Transmission function contents	9011 ... 909C	140	
(4) Time protocol of the transmission (actual result)	Number of operations/ commands	90A0 ... 90A3	4	00
	Current value	90A4 ... 90A7	4	
	Mean value	90A8 ... 90AB	4	
	Maximum value	90AC ... 90AF	4	
	Minimum value	90B0 ... 90B3	4	
(5) Number of repeats protocol (actual result)	Number of functions	90C0 ... 90C3	4	
	Current value	90C4,5	2	
	Mean value	90C6,7	2	
	Maximum value	90C8,9	2	
	Minimum value	90CA,B	2	
(6) Error protocol	Register protocol pointer	9100,1	2	9102
	Contents of error protocol	9102 ... 9D81	3200	00
(7) Display of the time	Second	A000	7	Time
	Minute	A001		
	Hour	A002		
	Day	A003		
	Month	A004		
	Year	A005		
	Weekday	A006		
(8) Instruction mode		A008	1	
(9) Response time		A009	1	
(10) Response return system		A00A	1	
(11) Read/write head scan last station		A00B	1	

The following addresses are reserved and blocked for transmission:
9001_h, 9004_h ... $900F_h$, $909D_h$ ... $909F_h$, $90B4$ ... $90BF_h$, $90C8_h$ ... $90FF_h$, $A007_h$

1. Recognition time see page 136.

2. Operating supervision by LEDs
   The start and the end of a transmission function can be checked by LEDs placed on the read/write heads and the data carriers.

Read/write head

LED: TX

Flashes in the case of a transmission between the read/write head and the data carrier.

LED: OK

Lights at the end of a transmission between a read/write head and the data carrier.
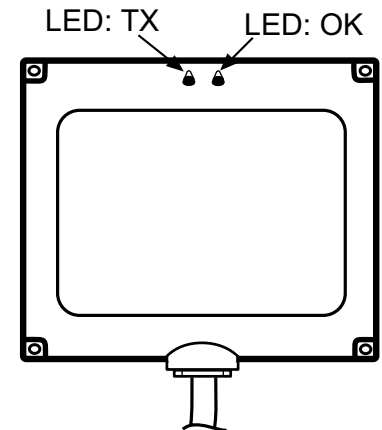
Setting	Set Area	Setting contents
LED: OK Lighting time T1	Memory address of MVI-D2-2HRX 9003_h	0 sec ... 25.5 sec. Initial value 0.5 sec. e. g. 255_d as 25.5 sec.

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Data carrier

LED - Lights at the start and at the end of a transmission.

LED
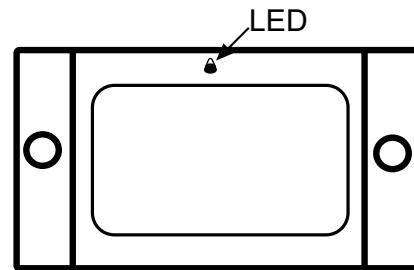
Setting	Set Area	Setting contents
Lighting time T2	Memory address of data carrier: 8054_h	0.2 sec ... 25.2 sec. (Initial value 0 sec.) e.g. 255_d as 25.5 sec.
Lighting instructions	Memory address of MVI-D2-2HRX: 9002_h	00_h: does not light 01_h: lights at the start of transmission FF_h: lights at the end of transmission

LED lighting time chart

Start of transmission

End of transmission

Read/write head

LED: TX

LED: OK

T1

Data carrier LED

T2

T2

LED lights at the start of transmission

LED lights at the end of transmission
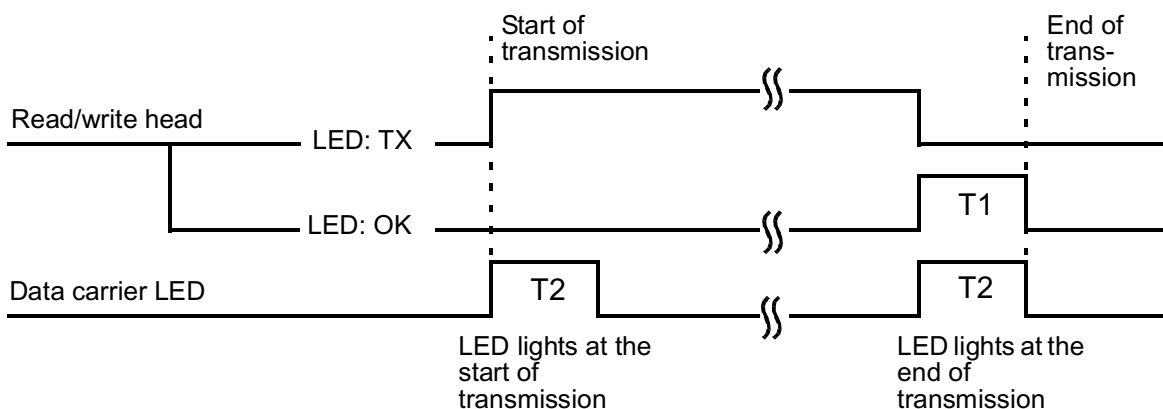
The LED lights when transmission is repeated: OK on the read/write head lights twice.

Without repeat

T1

With repeat

T1

T1
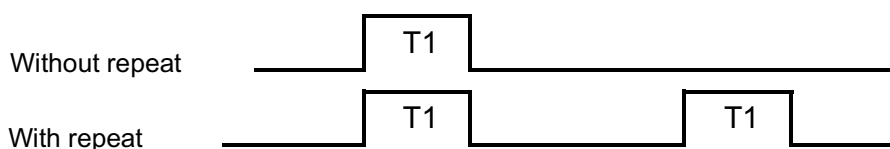
3. Storage of commands
   This storage and execution is only available when the command register system is used as communication startup system (set memory address A008$_h$ to 2).

• Storage
   Determine the contents of the transmission function (transmission code, attributes etc.) and store it as command.
   Determine the memory area by inserting storage numbers 1 to 8 into the field "registration" of the command.

• Execution method
   When the MVI-D2-2HRX receives the command (command code 75$_h$) from the host controller, the storage number, which is to be executed when the trigger input is activated, is stored in the MVI-D2-2HRX system memory (address 9010$_h$). Each time the trigger input is activated, the MVI-D2-2HRX executes the registered command, which is allocated by the host controller by means of the the 75$_h$ command.
   While the MVI-D2-2HRX trigger input is active, the communication function, allocated by command 75$_h$, is executed.

• Halt
   The instruction execution can be stopped by sending the command "halt" (command code 74$_h$). In this case, the MVI-D2-2HRX does not start the transmission even if the trigger input is active (ON) (address 9010$_h$ = 0).

• Other
   The MVI-D2-2HRX indicates an error when you try to start the function by means of the start command with other than the command register system.
   Store the write data to the data carrier buffer of the MVI-D2-2HRX.

Function Memory Table

Memory area	Number of bytes	Description	Address (hex.)	Number of bytes
Transmission function with a trigger signal	1	0: Block the function 1 to 8: Registration number (unblock the function)	9010	1
Reserved area	1		9011	1
Transmission function contents	Memory number 1 / 16	Tansmission code	9012	1
		Protection method	9013	1
		Attribute	9014	1
		Start address	9015	2
		Number of bytes	9017	2
		Start address of transmission target area	9019	2
		Data Code (DCD)	901B	1
		ID code	901C	4
		Clear data	9020	1
		Reserved area	9021	1
	⋮ ⋮	⋮	⋮	⋮
	Memory number 8 / 16	Tansmission code	9082	1
		Protection method	9083	1
		Attribute	9084	1
		Start address	9085	2
		Number of bytes	9087	2
		Start address of transmission target area	9089	2
		Data Code (DCD)	908B	1
		ID code	908C	4
		Clear data	9090	1
		Reserved data	9091	1
Reserved area	14		9092	

4. Time protocol of the transmission

The MVI-D2-2HRX stores the processing time from the start to the end of the transmission between the read/write head and the data carrier onto its memory addresses $90A0_h$ to $90B3_h$. These processing times are subdivided into current value, mean value, maximum and minimum value. The "clear protocol" function from the host controller can initialise the maximum, minimum and mean value. It is not possible to write with any other function.

Memory area		Contents		
		Before measuring transmission time	After measuring transmission time	Memory data
Transmission time (current result)	Number of functions	N'	N = N' + 1	0 ... 4.294.967.295$_d$ times
	Current value	T1'	T1	0 ... 4.294.967.295$_d$ ms
	Mean value	T2'	$T_2 = \dfrac{(T_2'*N')+T_1}{N'+1}$	
	Maximum value	T3'	T3' $\geq$ T1: max. value T3' T3' < T1: max. value T1	
	Minimum value	T4'	T4' $\leq$ T1: min. value T4' T4' > T1: min. value T1	

5. Number of communication attempts protocol

The MVI-D2-2HRX stores the number of repeats from the start to the end of transmission between the read/write head and the data carrier onto its memory addresses $90C0_h$ to $90CB_h$. The "clear protocol" function from the host controller can initialise the maximum, minimum and mean value. It is not possible to write with any other function.

Memory area		Contents		
		Before measuring transmission time	After measuring transmission time	Memory data
Transmission time (current result)	Number of operations	N'	N = N' + 1	0 ... 4.294.967.295$_d$
	Current value	R1'	R1	0 ... 255$_d$
	Mean value	R2'	$R_2 = \dfrac{(R_2'*N')+R_1}{N'+1}$	
	Maximum value	R3'	R3' $\geq$ R1: max. value R3' R3' < R1: max. value R1	
	Minimum value	R4'	R4' $\leq$ R1: min. value R4' R4' > R1: min. value R1	

6. Setting the current time
    Set the time of the clock integrated into the MVI-D2-2HRX to memory address
    A000$_h$ to A006$_h$ of MVI-D2-2HRX.

Memory area designation		Contents						
Display of current time	Second	00 ... 59 (BCD code)						
	Minute	00 ... 59 (BCD code)						
	Hour	00 ... 23 (BCD code)						
	Day	01 ... 31 (BCD code)						
	Month	01 ... 12 (BCD code)						
	Year	00 ... 99 (BCD code)						
	Weekday	Sun.	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.
		00$_h$	01$_h$	02$_h$	03$_h$	04$_h$	05$_h$	06$_h$

7. Error protocol
    When the result of a command is faulty the MVI-D2-2HRX stores the error
    protocol to its memory addresses 9100$_h$ to 9D81$_h$.

*   The MVI-D2-2HRX stores the error contents onto the address which is set 32
    bytes before the start address of the protocol in the "storage protocol pointer"
    (address: 9100$_h$, 9101$_h$).

*   After the storage of the error contents, the start address of the protocol is set 32
    bytes ahead of the "storage protocol pointer".

*   The initial value of the "storage protocol pointer" is 9102$_h$.

*   The error protocol area can be reset by means of the host controller's "clear
    protocol" function.

*   When the protocol data reach 100, the data is overwritten by protocol data 1.

Item	Number of bytes	Detailed item (contents)		Start address hex. h	Number of bytes
Storage protocol pointer	2	Start address of the protocol data of the last error storage		9100	2
Protocol data 1	32	Storage time	Second	9102	6
			Minute	9103	
			Hour	9104	
			Day	9105	
			Month	9106	
			Year	9107	
		Error code		9108	1
		Error information		9109	6
		Execution contents	Command	910F	1
			Attribute	9110	1
			ID code	9111	4
			Start address	9115	2
			Number of bytes	9117	2
			Target area start address	9119	2
		Data carrier error		911B	1
		Asynchronous error		911C	1
		Time-out error during the last data reception		911D	1
		Incorrect number of bytes		911E	1
		Check sum error		911F	1
		Grammatical error		9120	1
		Reserved area		9121	1
⋮	⋮	⋮		⋮	⋮
Protocol data 100	32	Storage time	Second	9D62	6
			Minute	9D63	
			Hour	9D64	
			Day	9D65	
			Month	9D66	
			Year	9D67	
		Error code		9D68	1
		Error information		9D69	6

Item	Number of bytes	Detailed item (contents)			Start address hex. h	Number of bytes
Protocol data 100	32	Execution contents	Command		9D6F	1
			Attribute		9D70	1
			ID code		9D71	4
			Start address		9D75	2
			Number of bytes		9D77	2
			Target area start address		9D79	2
		No data carrier error			9D7B	7
		Asynchronous error			9D7C	1
		Time-out error during the last reception of data			9D7D	1
		Byte counter error			9D7E	1
		Check sum error			9D7F	1
		Grammatical error			9D80	1
		Reserved area			9D81	1

8. Communication startup system

   The communication startup system is determined by the contents of the MVI-D2-2HRX memory address $A008_h$.

Area name of memory	Address	Setting contents	Initial value
Communication startup system	$A008_h$	00_h= Occasional execution system	00_h (Occasional execution system)
		01_h= Command stay system	
		02_h= Command register system	
		03_h= Read/write head scan system	

   In order to change the communication startup system, the content of the storage cell $A008_h$ should be overwritten and then the supply voltage of the control interface unit has to be switched OFF and then ON again.

9. Response time (RI)

   This function is used when the MVI-D2-2HRX returns another message immediately after instruction execution, while the host controller is still processing previous data.

10. Contents (between host controller and each MVI-D2-2HRX)

    [In the case of the auto response systems]

    This function is available, in order to insert a time interval in between the command and the "sending of acknowledgement".

Example: Occasional Execution + Auto Response System

Host controller   **Control interface unit**

Send command

Response
time: RI

Send acknowledgement

Execution of a function such as
transmission to a data carrier

*
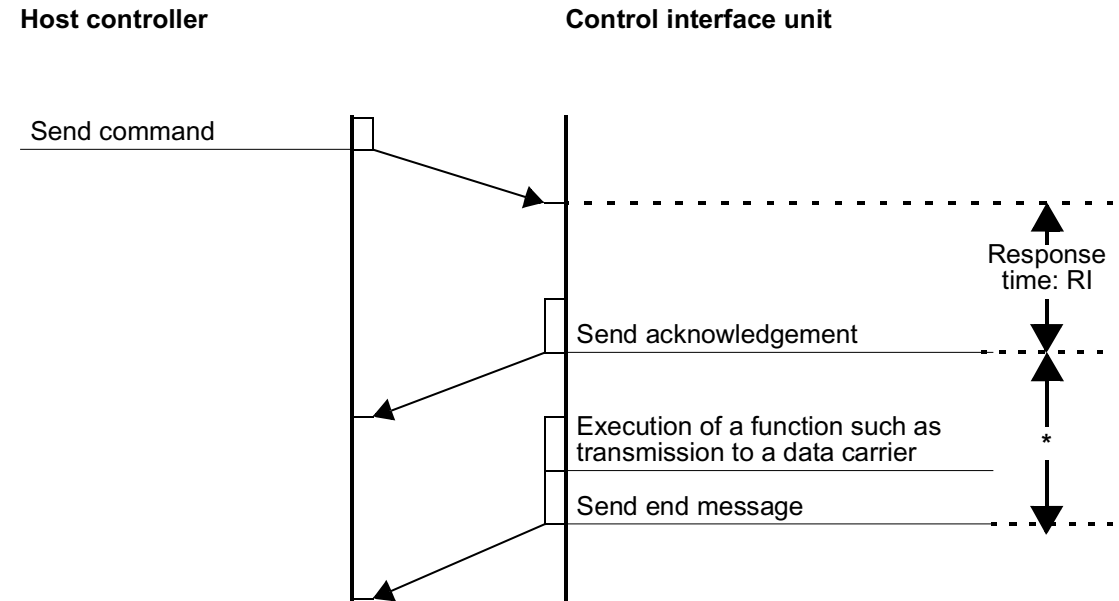
Send end message

*Period of time until end message is sent

- When the processing time between the read/write head and the data carrier is longer than the RI setting value, an end message is sent at the end of the processing between the read/write head and the data carrier.

- When the processing time between the read/write head and the data carrier is shorter than the RI setting value after sending the acknowledgement, the MVI-D2-2HRX delays transmission of the end message with the RI setting value.

[In the case of the response request systems]
This function is available, in order to insert an interval between receiving the command and sending the acknowledgement as well as between receiving the acknowledgement request and sending the end message.

Example: Occasional Execution + Response Request System

Host controller   Control interface unit
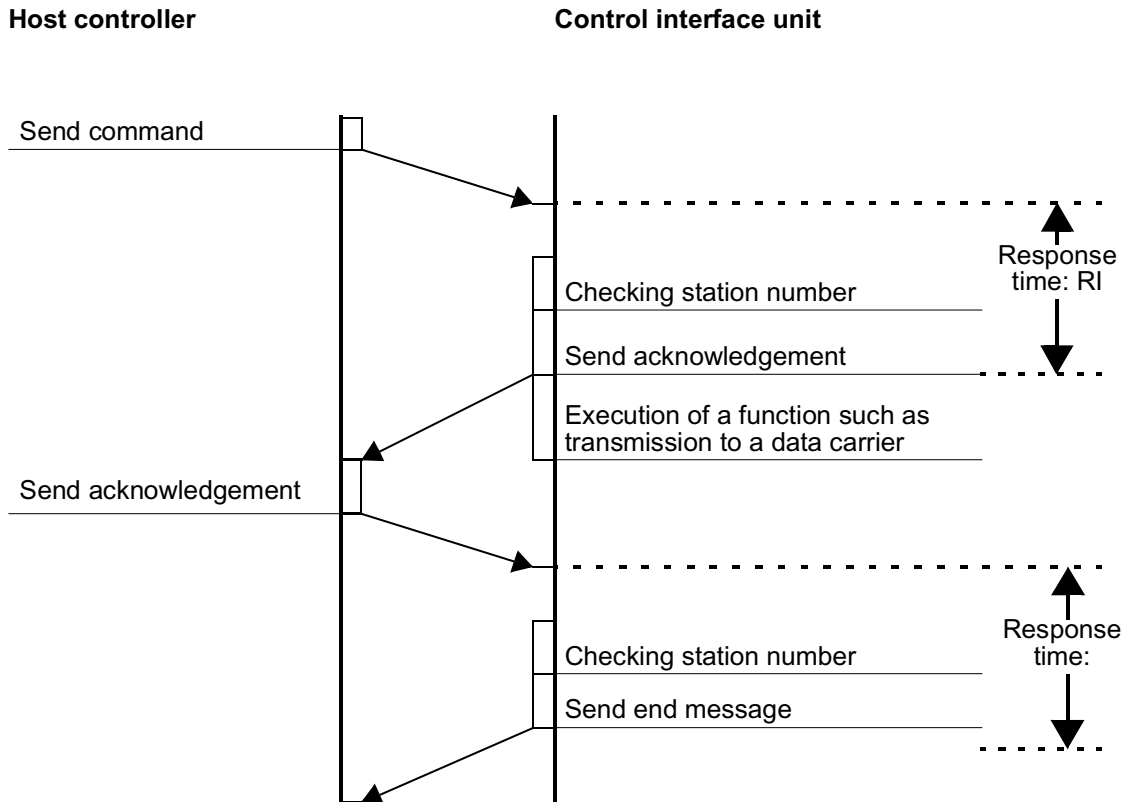
11. Setting values

The RI response time can be set to up to 600 ms in the system memory (address $A009_h$) of the MVI-D2-2HRX.

Setting value (hex.)	Response time RI (ms)	Setting value (hex.)	Response time RI (ms)
0	0	8	80
1	10	9	90
2	20	A	100
3	30	B	200
4	40	C	300
5	50	D	400
6	60	E	500
7	70	F	600

9   Commands

9.1   Common Code

ASCII code is used for commands and messages.

Data (ASCII)	Code (hex.)	Contents
STA	0 to F	Station number [1] (1) Command: Station number to receive data. (2) Message: Station number of the emitting station.
ANT	0,1, *	Read/write head number *(Used for allocating the access functions of the read/write head scan system and the MVI-D2-2HRX.)
SC(H), SC(L)	Two digits (00 to FF)	Checksum
EK(H), EK(L)	Two digits (00 to FF)	Position of occurred error 00: Between host controller and MVI-D2-2HRX 10: Between MVI-D2-2HRX and read/write head 0 11: Between MVI-D2-2HRX and read/write head [a]
EC(H), EC(L)	Two digits (00 to FF)	Error code
Error information	Twelve digits	Information on error contents such as start address of block check error
:	3A	Header (indicates the head of the command and the response).
?	3F	Indicates the command
$	24	Indicates acknowledgement (normal operation).
#	23	Indicates end message (normal operation).
%	25	Indicates error message.
!	21	Indicates command for communication of a specific control interface unit with the read/write head scan system
CR	0D	End code (indicates end of command or message).[b]

a. Set "0" in order to select read/write head scan function.
b. Some languages used by the host controller automatically add "CR". In this case, the "CR" command is not required.

9.2   Instruction Format

9.2.1   Standard Format
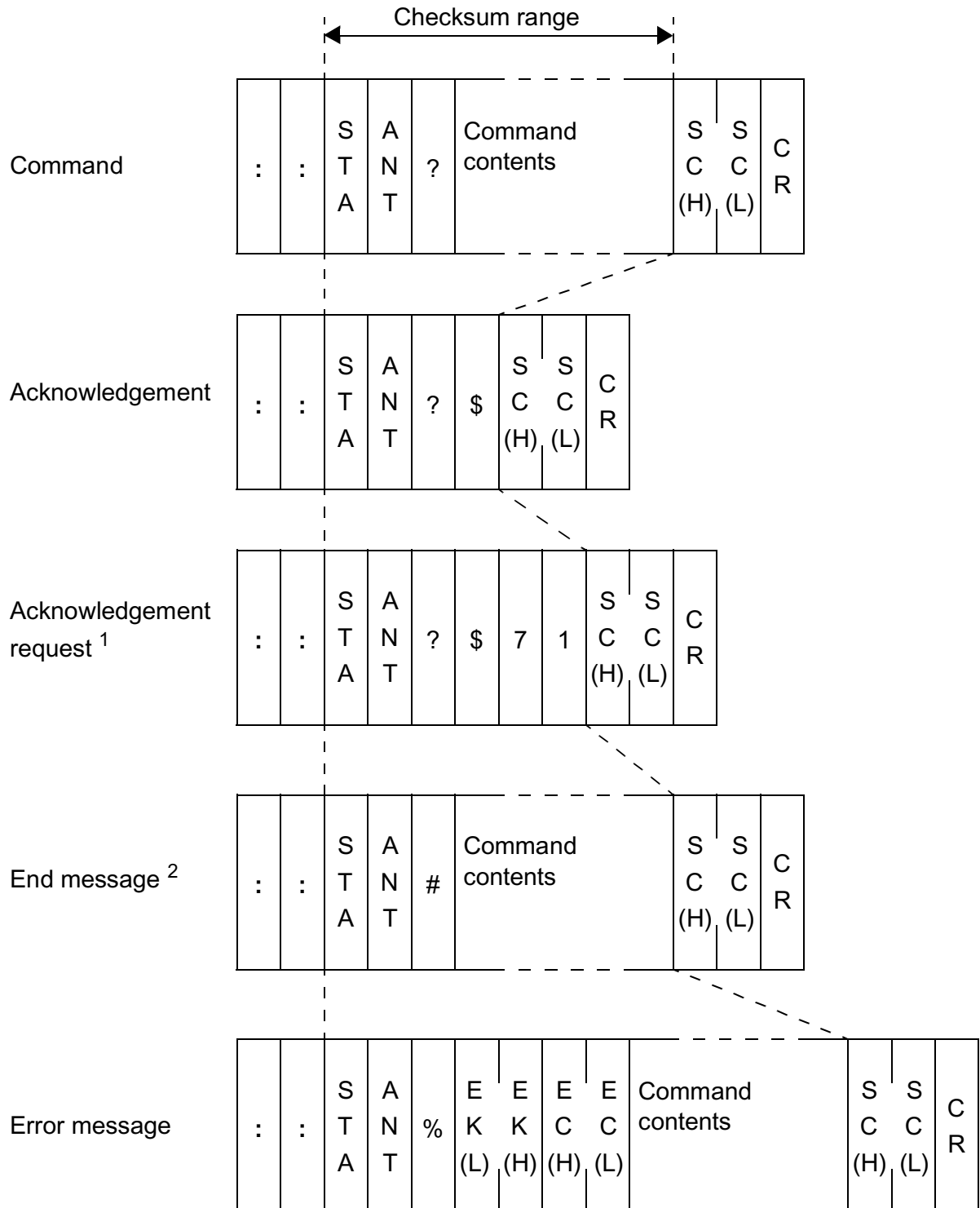
[1] When the MVI-D2-2HRX completes an operation, while receiving an acknowledgement request, it sends the following end message to the host controller.

:	:	S T A	A N T	#	7	1	S C (H)	S C (L)	C R

When the MVI-D2-2HRX receives an acknowledgement request, when it has already finished the operation, it sends the normal end message to the host controller.

[2] As soon as the command register system has stored an operation in the MVI-D2-2HRX, the following end message is sent to the host controller.

:	:	S T A	A N T	#	7	Command code	Registration	S C (H)	S C (L)	C R

9.2.2 Setting the Read/Write Station Number

Set read/write head number ("0" or "1") in order to execute the command.

- The number of the read/write head is determined by the terminal number of the read/write head at the MVI-D2-2HRX.

- When the read/write head scan is used, the character " *" is inserted in the command.

- In order to copy data (with check) between the read/write heads, the read/write head number of the data source has to be set.

- When the special area of the MVI-D2-2HRX system memory is accessed, the host controller accesses the same address, disregarding whether the command is set to 0 or 1.

9.2.3 Check Sum

In order to improve the reliability of the data transmission, the MVI-D2-2HRX can ascertain errors both with checksum tests and parity checks (Checksum range see page 121).
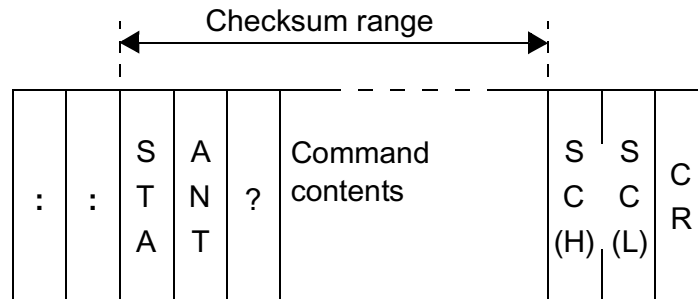
Test procedure

1. All data of the station number is added up to the end of the command contents or to the end of the messages, and the lowest byte of this amount is converted to ASCII.

2. The data is correct when the sum across the checksum range and the checksum itself is 0. When the overall result is a number not equal to 0, this is treated as an error.

Data creation during the checksum procedure

1. Adds up the ASCII values of the station numbers up to the command contents or to the end of the message contents (just before the checksum code).

2. Constitutes the two's complement from this sum.

• Two's complement: All data bits are inverted (0 to 1, 1 to 0) and 1 is added.

Ex.: Two's complement of $4E_h$ is $B2_h$.

$4E_h$ →   01001110

            ↓   invert

            10110001

            ↓   add 1

            10110010   → $B2_h$

3. Divide the data to the first 4 bits and the second 4 bits and convert them to ASCII code.

When the calculation of the checksum is too expensive, the checksum can be replaced by "@@".

9.2.4 Allocation of the Read/Write Head Scan System

In order to set the station number of the read/write head scan system, enter the station number and the read/write head numbers and execute the following functions. For information concerning connection method, switch setting, type of transmission and functions see the following pages.

Item	Station number	Setting read/write head number
Command	0 (fixed)	* (fixed)
Acknowledgement	0 (fixed)	* (fixed)
End message	MVI-D2-2HRX station number, which completes the process with the data carrier	MVI-D2-2HRX read/write head number, which completes the process with the data carrier

Command setting

Read/write head number

Station number

Date of issue   03.05.2001
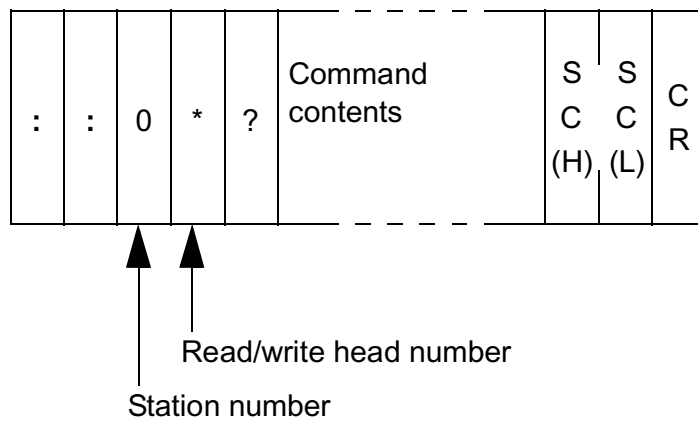
9.2.5 Accessing a Specific Read/Write Head of a Specific Station

Via MVI-D2-2HRX with station number "0"

Item	Station number	Setting read/write head number
Command	Each station number connected to station number "0".	0 or 1
Acknowledgement	same as above	same as above
End message	same as above	same as above

Example command setting:

Accessing a data carrier in front of read/write head number 1 of MVI-D2-2HRX station number "2".

Command code

Read/write head number

Station number
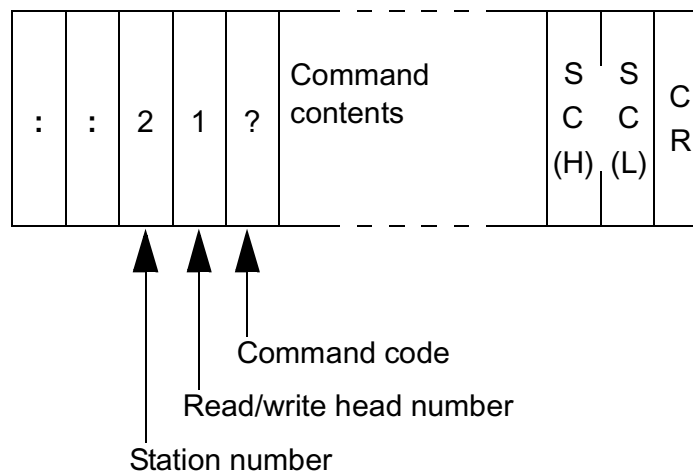
9.3 Command Sets of the Transmission Systems

9.3.1 Occasional Execution System + Auto Response System

Host   **MVI-D2-2HRX**

Command

| : | : | S T A | A N T | Com- mand contents | S C (H) | S C (L) | C R |

OK ⌐ NG

Acknowledgement

| : | : | S T A | A N T | $ | S C (H) | S C (L) | C R |

Execute command (e.g. communication with a data carrier)

OK ⌐ NG

End message

| : | : | S T A | A N T | # | Result | S C (H) | S C (L) | C R |

Error message

Error messages are indicated when errors occur during the acknowledgement or the end message.

| : | : | S T A | A N T | % | E K (H) | E K (L) | E C (H) | E C (L) | Error information | S C (H) | S C (L) | C R |

9.3.2 Occasional Execution System + Response Request System

Host   **MVI-D2-2HRX**

Command

Acknowledgement

Acknowledgement request

Execute command (e.g. communication with a data carrier)

End message

Result

Error messages are indicated when errors occur during the acknowledgement or the end message.

Error message

Error information

9.3.3 Command Stay System + Auto Response System

Host   **MVI-D2-2HRX**

Command

| : | : | S T A | A N T | ? | Com-mand contents | S C (H) | S C (L) | C R |

OK   NG

Acknowledgement

| : | : | S T A | A N T | $ | S C (H) | S C (L) | C R |

[Trigger input ON]

Acknowledgement request

| : | : | S T A | A N T | ? | 7 | 1 | S C (H) | S C (L) | C R |

Execute command (e.g. communication with a data carrier)

OK   NG

End message

| : | : | S T A | A N T | # | Result | S C (H) | S C (L) | C R |

Command

| : | : | S T A | A N T | ? | Com-mand contents | S C (H) | S C (L) | C R |

OK   NG

Acknowledgement

| : | : | S T A | A N T | $ | S C (H) | S C (L) | C R |

Switches on the occasional execution system while the trigger input is ON.

Acknowledgement request

| : | : | S T A | A N T | ? | 7 | 1 | S C (H) | S C (L) | C R |

Execute command (e.g. communication with a data carrier)

OK   NG

End response

| : | : | S T A | A N T | # | Result | S C (H) | S C (L) | C R |

Error messages are indicated when errors occur during the acknowledgement or the end message.

Error message

| : | : | S T A | A N T | % | E K (H) | E K (L) | E C (H) | E C (L) | Error informa-tion | S C (H) | S C (L) | C R |

Date of issue 03.05.2001

9.3.4 Command Stay System + Response Request System

Host **MVI-D2-2HRX**

Command

| : | : | S T A | A N T | ? | Com-mand contents | S C (H) | S C (L) | C R |

OK NG

Acknowledgement

| : | : | S T A | A N T | $ | S C (H) | S C (L) | C R |

[Trigger input ON]

Acknowledgement request

| : | : | S T A | A N T | ? | 7 | 1 | S C (H) | S C (L) | C R |

Execute command (e.g. communication with a data carrier)

NG
OK

End message

| : | : | S T A | A N T | # | Result | S C (H) | S C (L) | C R |

Command

| : | : | S T A | A N T | ? | Com-mand contents | S C (H) | S C (L) | C R |

OK NG

Acknowledgement

| : | : | S T A | A N T | $ | S C (H) | S C (L) | C R |

Switches on the occasional execution system while the trigger input is ON.

Acknowledgement request

| : | : | S T A | A N T | ? | 7 | 1 | S C (H) | S C (L) | C R |

Execute command (e.g. communication with a data carrier)

NG
OK

Acknowledgement request

| : | : | S T A | A N T | # | Result | S C (H) | S C (L) | C R |

Error message

Error messages are indicated when errors occur during the acknowl-edgement or the end message.

| : | : | S T A | A N T | % | E K (H) | E K (L) | E C (H) | E C (L) | Error informa-tion | S C (H) | S C (L) | C R |

9.3.5 Command Register System + Auto Response System

Host **MVI-D2-2HRX**

Command (when trigger input is ON)

: : S T A | A N T | ? | 7 | 5 | SC (H) | SC (L) | C R

OK | NG

Acknowledgement

: : S T A | A N T | $ | SC (H) | SC (L) | C R

[Trigger input ON]

Execute command (e.g. communication with a data carrier)

OK | NG

End message (for a stored command)

: : S T A | A N T | # | Result | SC (H) | SC (L) | C R

Start next command

: : S T A | A N T | ? | 7 | 6 | SC (H) | SC (L) | C R

Enables commands as long as the trigger input is ON.

OK | NG

Acknowledgement

: : S T A | A N T | $ | SC (H) | SC (L) | C R

Repeat at each turn ON of the trigger input

Execute command (e.g. communication with a data carrier)

OK | NG

End message (for a stored command)

: : S T A | A N T | # | Result | SC (H) | SC (L) | C R

Error messages are indicated when errors occur during the acknowledgement or the end message.

Error message

: : S T A | A N T | % | EK (H) | EK (L) | EC (H) | EC (L) | Error information | SC (H) | SC (L) | C R

Date of issue 03.05.2001

9.3.6 Command Register System + Response Request System

Host   **MVI-D2-2HRX**

Command (when trigger input is ON)

| : | : | S T A | A N T | ? | 7 | 5 | S C (H) | S C (L) | C R |

OK   NG

Acknowledgement

| : | : | S T A | A N T | $ | S C (H) | S C (L) | C R |

[Trigger input ON]

Acknowledgement request

| : | : | S T A | A N T | ? | 7 | 1 | S C (H) | S C (L) | C R |

Execute command (e.g. communication with a data carrier)

OK   NG

End message (for a stored command)

| : | : | S T A | A N T | # | Result | S C (H) | S C (L) | C R |

Start next command

| : | : | S T A | A N T | ? | 7 | 6 | S C (H) | S C (L) | C R |

OK   NG

Acknowledgement

| : | : | S T A | A N T | $ | S C (H) | S C (L) | C R |

Repeat at each turn ON of the trigger input

Enables commands as long as the trigger input is ON.

Acknowledgement request

| : | : | S T A | A N T | ? | 7 | 1 | S C (H) | S C (L) | C R |

Execute command (e.g. communication with a data carrier)

OK   NG

End message (for a stored command)

| : | : | S T A | A N T | # | Result | S C (H) | S C (L) | C R |

Error message

Error messages are indicated when errors occur during the acknowledgement or the end message.

| : | : | S T A | A N T | % | E K (H) | E K (L) | E C (H) | E C (L) | Error information | S C (H) | S C (L) | C R |

9.3.7 Read/Write Head System + Auto Response System

Host   **MVI-D2-2HRX**

Command

| : | : | 0 | * | ? | Com-mand contents | S C (H) | S C (L) | C R |

Read/write head scan instruction

Fixed station number "0"

OK NG

Acknowledgement

| : | : | S T A | A N T | $ | S C (H) | S C (L) | C R |

Execute command (e.g. communication with a data carrier)

OK NG

End message

| : | : | S T A | A N T | # | Result | S C (H) | S C (L) | C R |

Station number and read/write head number of last station (via station number "0")

Command (for operation with a specific read/write head of a specific station)

| : | : | S T A | A N T | ? | Com-mand contents | S C (H) | S C (L) | C R |

Note: Connected to the host controller via station number "0"

OK NG

Acknowledgement

| : | : | S T A | A N T | $ | S C (H) | S C (L) | C R |

Execute command (e.g. communication with a data carrier)

OK NG

End message

| : | : | S T A | A N T | # | Result | S C (H) | S C (L) | C R |

Station number and read/write head number of last station (via station number "0")

Error messages are indicated when errors occur during the acknowledgement or the end message.

Error message

| : | : | S T A | A N T | % | E K (L) | E K (H) | E C (H) | E C (L) | Error informa-tion | S C (H) | S C (L) | C R |

9.3.8 Read/Write Head Scan System + Response Request System

Host   **MVI-D2-2HRX**

Command

Command contents — Read/write head scan instruction

Fixed station number "0"

Acknowledgement request

Acknowledgement

Execute command (e.g. communication with a data carrier)

End message

Result — Station number and read/write head number of last station (via station number "0")

Command (for operation with a specific read/write head of a specific station)

Command contents

Note: Connected to the host controller via station number "0"

Acknowledgement

Execute command (e.g. communication with a data carrier)

End message

Result

Station number and read/write head number of last station (via station number "0")

Error messages are indicated when errors occur during the acknowledgement or the end message.

Error message

Error information

9.4 Commands and End Messages

9.4.1 General Format

Command

:	:	S T A	A N T	?	Comm. code	Register	P R O	Attribut	Addresses, number of bytes, ID codes etc.	S C (H)	S C (L)	C R

Contents depending on communication command

End message

:	:	S T A	A N T	#	Comm. code	Register	P R O	Attribut	Addresses, number of bytes, ID codes etc.	S C (H)	S C (L)	C R

Contents depending on communication command
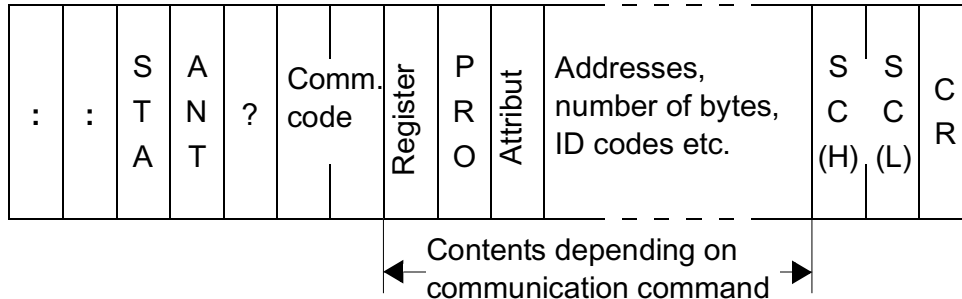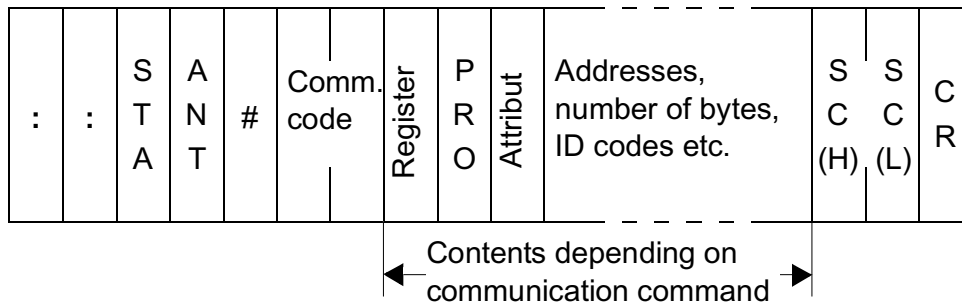
Transmission code:	Contents of the transmission function to instruct the MVI-D2-2HRX.
Register:	For allocating the storage destination of the transmission function within the command register system.
PRO:	For setting the data protection and the destination after the writing process.
Attribute:	Start mode for communication with a data carrier.

9.4.2 General Commands

Register (Coded with an ASCII-Character)

Number of the transmission function's memory area in the command register system.

- Specify the destination number for the command which stores the function (system memory or MVI-D2-2HRX).

- Codes 1 to 8 are available for setting (number of each memory area).

- The data carrier access function represents a transmission function which can be stored.

- The stored transmission function is a function, which is enabled by the 75_h command.

PRO: Setting the Save Areas (Coded as ASCII Character)

This function protects the data written in a data carrier from inadvertently being overwritten.

- After writing data to a data carrier, the MVI-D2-2HRX automatically sets the desired write-protected area (starting address and number of bytes) to the preset write-protected area of the data carrier.

- Number of the desired write-protected area (protection from 1 to A (10 positions) for MVC-60-64K)

- Setting code:

  1 to A   Protection after writing

  *   No protection after writing

- List of commands which can be write-protected.

Transmission function	code
Write	20
Write and check	21
Write ID code	22
Write data from MVI-D2-2HRX to data carrier	23
Write and check data from MVI-D2-2HRX to data carrier	24
Clear	30
Copy data between read/write heads	40
Copy and check data between read/write heads	41

Notes:

- The protection setting of a copy command is intended for the destination of the copied data on the data carrier.

- For commands, other than the above mentioned, set: "*" (no protection).

Attributes of the Communication Start System (Between Read/Write Head and Data Carrier)

The attribute determines whether the data carrier detection time shall be limited (single read) or unlimited (auto read). Moreover, it determines whether all data carriers, data carriers with specific or data carriers with other ID codes shall be activated. The attribute also determines whether the end message is to be sent with or without the ID code.

Data carrier detection method:
At the start of communication with a data carrier, the data carrier should be within the transmission range of a read/write head. In order to detect a data carrier within the transmission area both an external switch (auto read) and a read/write head (single read) can be used. For setting see page 138.

Data carrier detection method	Contents
Single read	Detects the presence of a data carrier within the transmission area by means of a signal from an external switch (e.g. proximity switch) and then starts the transmission.
Auto read	The read/write head constantly tries to detect a data carrier. The read/write head automatically starts transmission when the data carrier is within the transmission area.

The transmission limitation time is stored in the MVI-D2-2HRX memory (address: 9000_h).

| Data carrier detection method	Transmission limitation time = 0	Transmission limitation time > 0
Single read	Fixed transmission limitation time (from the start to the end of the transmission)	Variable transmission limitation time (from the start to the end of the transmission)
Auto read	Fixed transmission limitation time after detecting the data carrier	Variable transmission limitation time after detecting the data carrier

ID Code Allocation

When different types of ID codes are stored in the data carriers, it is possible to communicate with a data carrier that has a specific ID code by means of commands with ID code allocation. This data carrier can also be excluded from communication.

ID code allocation		Contents
Without allocation		The read/write head communicates with each data carrier in the transmission area.
With allocation	Allocated function	Set the ID code in the command by the host controller. The read/write head does only communicate with the allocated data carrier.
	Allocated non-function	Set the ID code in the command by the host controller. The read/write head communicates with other than the allocated data carrier.

- ID code storage position: Memory address 8040_h to 8043_h of the data carrier.

- ID code setting value: 1 to 4.294.967.296

- It should be noted that ID codes do not occur twice.

- For the allocated function and non-function, set the ID code in the command for allocation.

Ex.: When the read/write head starts transmission to data carriers and when there are three data carriers within the transmission area.

Pallet 1   Pallet 2   Pallet 3

Data carrier
(ID code: 1)

Data carrier
(ID code: 3)

Transmission area

Data carrier
(ID code: 2)

Read/
write head
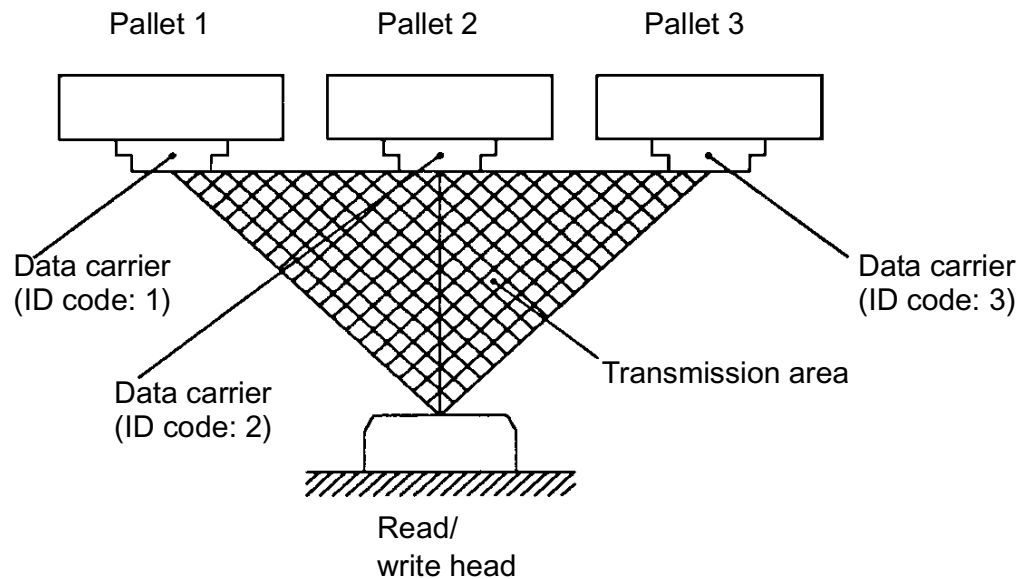
1. When selecting "without ID code allocation" an error message occurs, which indicates that there is no data carrier within the transmission area.

2. When the ID code is set to "1" together with "allocated function" and with "ID code allocation", the read/write head does only communicate with the data carrier of pallet 1 and no transmission error is indicated.

3. When the ID code is set to "1" together with "allocated non-function" and with "ID code allocation", the read/write head does only communicate with the data carriers of pallets 2 and 3. "No data carrier error" is indicated together with the transmission error.

Allocation of the ID Code Return

In the case of a response to the host controller, this function serves to return the ID codes of the accessed data carriers. When returning the ID code, the response becomes 4 bytes (8 ASCII characters) longer than without ID code return.

Setting the Attributes

Selection values of the communication start system and the ID code returns between a read/write head and data carriers are referred to as attribute codes.

- The attribute code consists of detection method, ID code allocation and allocation of ID code return/non-return.

- The attribute code is represented by one ASCII character.

- When ID codes allocate function or non-function, they should be set in the command (ID code setting position is described at each message of the transmission function).

- If no ID code is allocated, an ID code setting for the command is not required.

- Attribute code

Communication startup system		Attribute code (ASCII code)		Notes
Data carrier detection method	**ID code allocation**	**Without ID code return**	**With ID code return**	
Single read	None	0	A	-
	Allocated function	1	B	ID code must be set in the command.
	Allocated non-function	2	C	
Auto read	None	3	D	-
	Allocated function	4	E	ID code must be set in the command.
	Allocated non-function	5	F	

Setting Range of the Transmission Function

Setting position

The transmission area is given in terms of a starting address and the number of bytes. Hexadecimal numbers in ASCII code (4 bytes) are used for the setting.

- Format

- Some areas in the data carrier's system area (8000_h and after) as well as the MVI-D2-2HRX system area (9000_h and after) can neither be read nor written upon.

- All data of the data carrier's data area (MVC-60-64K: 0000_h to $ID7F_h$) can be written and read. However, the write function is not available for write-protected areas.

- Set addresses

Data carrier

		Data carrier	
		MVC-60-64K, MVC-60B-64K	**MVC-60-256K**
Data area	Number of bytes	7552	30976
	Address (hexadecimal)	0000 .... 1D7F	0000 ... 78FF
System area	Number of bytes	126	126
	Address (hexadecimal)	8000 ... 807D	8000 ... 807D

Control interface unit:

- Data carrier buffer area: same as the above mentioned data carrier.

- System area for data carrier transmission: 9000_h to $9D81_h$

- MVI-D2-2HRX special system area: $A000_h$ to $A00B_h$

Setting Range:

The maximum number of bytes is different for each transmission function.

Transmission function		Classifi-cation[a]	Transm. code (hex.)	Max. number of bytes	
				MVC-60*-64K	MVC-60-256K
Read	Read	P	10	512	
	Read and check	P	11	512	
	Read data from data carrier to MVI-D2-2HRX.	P	13	7552	30976
	Read and check data from data carrier to MVI-D2-2HRX	P	14	7552	30976
	Read MVI-D2-2HRX	P	15	512	
Write	Write	P	20	512	
	Write and check	P	21	512	
	Write data from MVI-D2-2HRX to data carrier	P	23	7552	30976
	Write and check data from MVI-D2-2HRX to data carrier	P	24	7552	30976
	Write MVI-D2-2HRX	C	25	512	
Clear	Clear	P	30	7552	30976
	Clear MVI-D2-2HRX	C	35	7552	30976
Copy	Copy data between read/write heads	P	40	7552	30976
	Copy and check data between read/write heads	P	41	7552	30976
Diagnosis	Self-diagnosis of data carrier[b]	P	50	7552	30976
	RAM check	P	52	7552	30976
	Block check	P	60	7552	30976

a. "P" denotes the data carrier access function,
   "C" denotes the MVI-D2-2HRX access function.
b. The indicated setting range applies to the RAM check.

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When transferring data of more than 512 bytes, please proceed in the following way:

From Data Carrier to Host Controller

- Repeated reading of data with up to 512 bytes by means of the read instruction (10_h).

- Combine the MVI-D2-2HRX read instruction (15_h) with reading from the data carrier to the MVI-D2-2HRX (command 13_h) or with reading and checking from the data carrier to the MVI-D2-2HRX (command 14_h).

Read data from the data carrier to the MVI-D2-2HRX data carrier buffer together with the data carrier's read data (with check) to the MVI-D2-2HRX (max. 7552 or 30976 bytes).

Read data "n" times in units of 512 bytes by means of the MVI-D2-2HRX read instruction from the host controller to the MVI-D2-2HRX data carrier memory, at any point in time. (However, the data quantity might be less than 512 bytes during the last transmission).

From Host Controller to Data Carrier

- Repeat writing of data with up to 512 bytes by means of the write instruction (20_h).

- Combine the MVI-D2-2HRX write instruction (25_h) with writing from the MVI-D2-2HRX to the data carrier command (23_h) or with writing and checking from the MVI-D2-2HRX to the data carrier command (24_h).

Write data with "n" times 512 bytes from the host controller to the data carrier buffer by means of the MVI-D2-2HRX write instruction, before the data carrier arrives. (However, the data quantity might be less than 512 bytes during the last transmission).

On arrival of the data carrier, the data stored in the MVI-D2-2HRX data carrier buffer are written on the data carrier containing the write data (with check) of the MVI-D2-2HRX (max. 7552 or 30976 bytes).

Setting the Data Format

Data Code (DCD)

Two types of characters are available for the data code: hexadecimal ASCII code and one byte JIS code.

- Enter one digit of an alphabetical ASCII character to select the data code.

- Both ($3A_h$) and CR ($0D_h$) can be used to write and clear data with one byte JIS character.
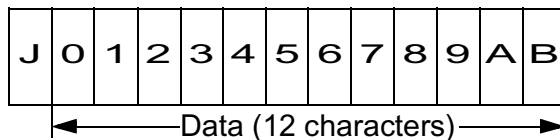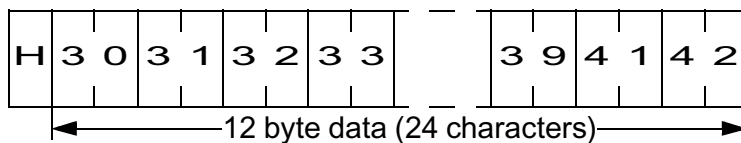
Format

- When data is contained in the end message during reading, set the data code after the number of instruction bytes.

- When data is contained in the end message during writing, set the data code before the data.

- When the "ID code allocated function/non-function" is selected, the ID code allocation of the command is also added.

- In the case of "with ID code acknowledgement" the code destination of the ID code is added to the message.

Data code	Set value	Characters required for one byte
Hexadecimal	H	Two characters (00 ... FF)
JIS character	J	One character

Format Example

Command: Without ID code allocation
Response: Without ID code message

```
┌─┬─┬─┬─┬─┬─┬─┐   ┌─┬─┬─┬─┬─┐
│H│3│0│3│1│3│2│3│3│ │3│9│4│1│4│2│
└─┴─┴─┴─┴─┴─┴─┘   └─┴─┴─┴─┴─┘
   ◄──────12 byte data (24 characters)──────►
```

```
┌─┬─┬─┬─┬─┬─┬─┬─┬─┬─┬─┬─┐
│J│0│1│2│3│4│5│6│7│8│9│A│B│
└─┴─┴─┴─┴─┴─┴─┴─┴─┴─┴─┴─┘
   ◄──────Data (12 characters)──────►
```

Command: With ID code allocation
Response: With ID code message

```
┌─┬─┬─┬─┬─┬─┬─┬─┬─┬─┬─┬─┬─┬─┐   ┌─┬─┬─┬─┬─┐
│H│3│0│3│1│3│2│3│3│3│0│3│1│3│2│3│3│ │3│9│4│1│4│2│
└─┴─┴─┴─┴─┴─┴─┴─┴─┴─┴─┴─┴─┴─┘   └─┴─┴─┴─┴─┘
   ◄────ID code────►◄──────12 byte data (24 characters)──────►
        (8 characters)
```

```
┌─┬─┬─┬─┬─┬─┬─┬─┬─┬─┬─┬─┬─┬─┐
│J│0│1│2│3│0│1│2│3│4│5│6│7│8│9│A│B│
└─┴─┴─┴─┴─┴─┴─┴─┴─┴─┴─┴─┴─┴─┘
 ◄ID code►◄──────Data (12 characters)──────►
  (8 char.)
```
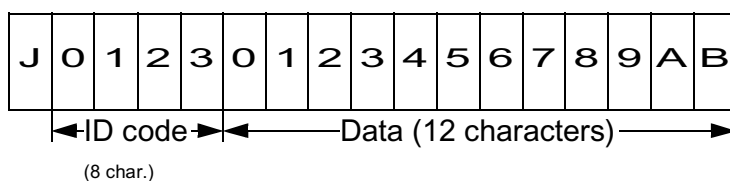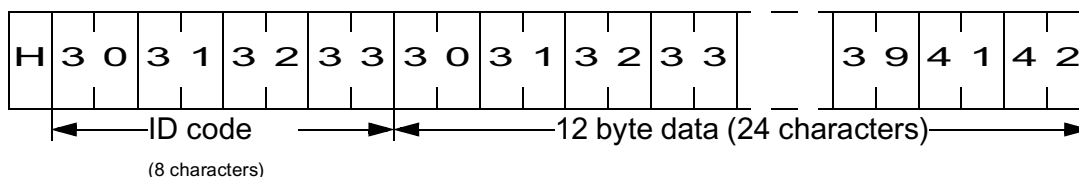
9.4.3   Overview of Commands

Read

Write

Copy

Diagnostic Commands

Other Functions

9.4.4 File Description of All Commands

Read (Transmission Code: 10$_h$)

Read and Check (Transmission Code: 11$_h$)

This command reads data in a data carrier from a specific starting address with a specific number of bytes and transfers it to the host controller. The maximum number of readable bytes is 512.

Command

End message

1) In the case of the occasional execution system, command stay system, or read/write head scan system, this function sets "*" for the command storage. In this setting the end message is also stored as "*".

Data Transmission
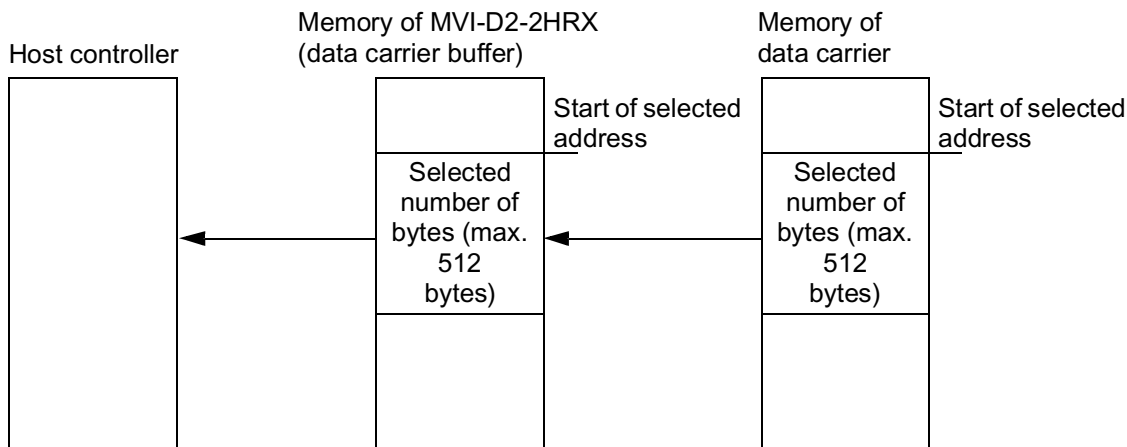
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Reading ID Code (Transmission Code: 12$_h$)

This command reads ID codes (address: 8040$_h$ to 8043$_h$, 4 bytes), which are stored in the data carrier system memory and transfers them to the host controller.

Command

:	:	S T A	A N T	?	1	2	Registration 1)	*	Attribute 2)	D C D	S C (H)	S C (L)	C R

Note: When the attribute is "ID code allocated function/non-function", the function adds the ID code at the end of the data code (DCD).

End message

:	:	S T A	A N T	?	1	2	Registration 1)	*	Attribute 2)	D C D	Data ID code	S C (H)	S C (L)	C R

1) In the case of the occasional execution system, command stay system, or read/write head scan system, this command sets "*" into the command memory. In this setting the command also stores "*" in the end message.

2) Both data formats, hexadecimals: h, and JIS: j are available.
Hexadecimal: 00000000$_h$ to FFFFFFFF$_h$ (8 digits)
JIS: Four digits JIS code.

Data Transmission

Host controller   Memory of MVI-D2-2HRX (data carrier buffer)   Memory of data carrier

ID code (4 bytes) ← ID code (4 bytes)

8040$_h$ 8043$_h$ 8040$_h$ 8043$_h$
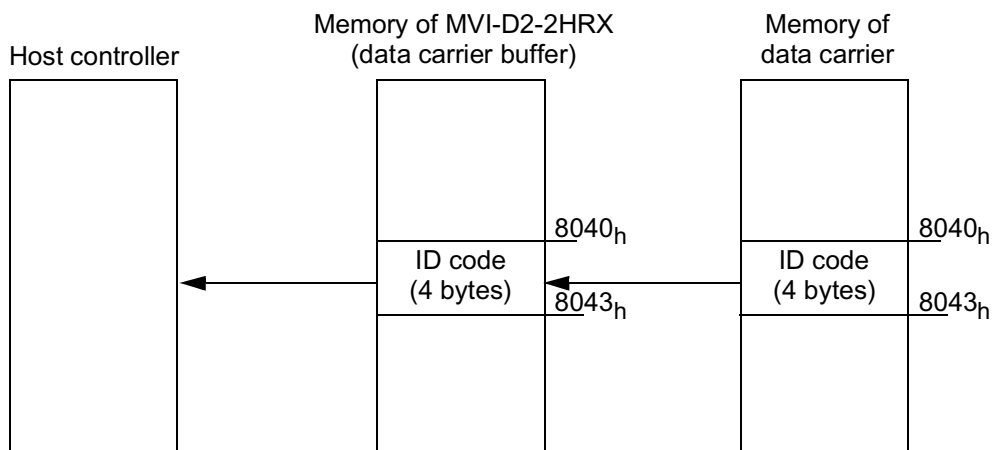
**Reading Data from Data Carrier to Control Interface Unit
(Transmission Code: 13$_h$)**

**Read and check Data from Data Carrier to MVI-D2-2HRX
(Transmission Code: 14$_h$)**

This command transmits data from a specific starting address in the data carrier memory (transmission source data) with a specific number of bytes to a specific starting address (transmission destination) in the MVI-D2-2HRX data carrier buffer. The maximum number of readable bytes is 7552.

Command
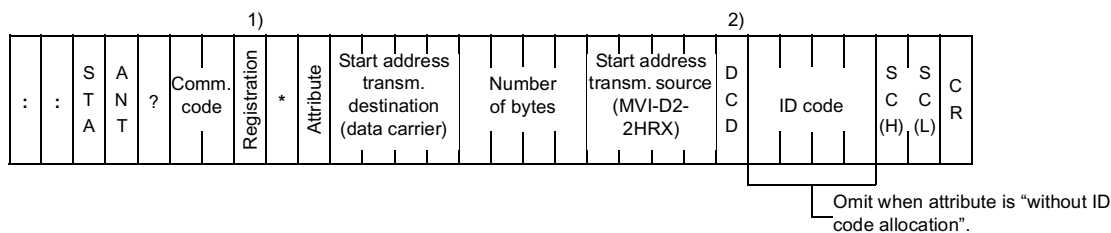
End message
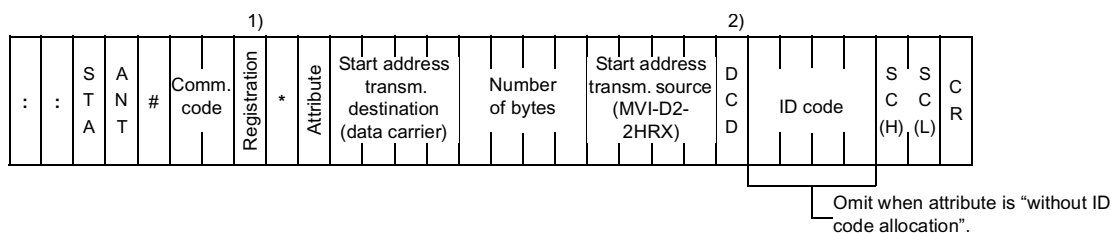
1) In the case of the occasional execution system, command stay system, or read/write head scan system, this command sets "*" into the command memory. In this setting the command also stores "*" in the end message.

2) In the case of "adding ID code message", it is necessary to set the data code of the ID code to DCD or to command (hexadecimal: h, JIS: j).
   In the case of "without ID code message", the command sets "*" to DCD of the command.

Data Transmission

In conjunction with the read instruction of the MVI-D2-2HRX (transmission code: 15$_h$) this command can transmit a multitude of data from a data carrier to a host controller.
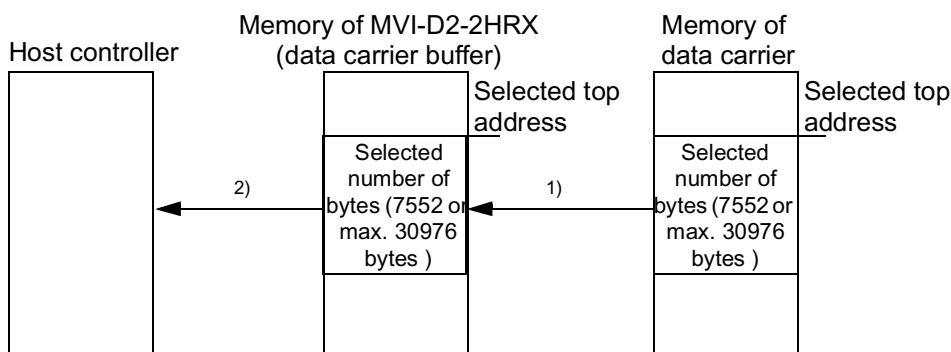
1) Read and check data from a data carrier to an MVI-D2-2HRX (max. 7552 or 30976 bytes).
2) Read data from an MVI-D2-2HRX (max. 512 bytes).

Reading the Control Interface Unit (Transmission Code: 15$_h$)

This command transmits data from a specific starting address and a specific number of bytes of the MVI-D2-2HRX (data carrier buffer, system memory) to the host controller.

- The maximum number of readable bytes is 512.

- When reading data from the MVI-D2-2HRX special area, this command reads data in the same area regardless of whether the number of the read/write head command (ANT) is 0 or 1.

Command

:	:	S T A	A N T	?	1	5	Start address	Number of bytes	D C D	S C (H)	S C (L)	C R

End message

:	:	S T A	A N T	#	1	5	Start address	Number of bytes	D C D	Data 1	Data 2	Data n	S C (H)	S C (L)	C R

Data Transmission

Reading the system memory of the control interface unit
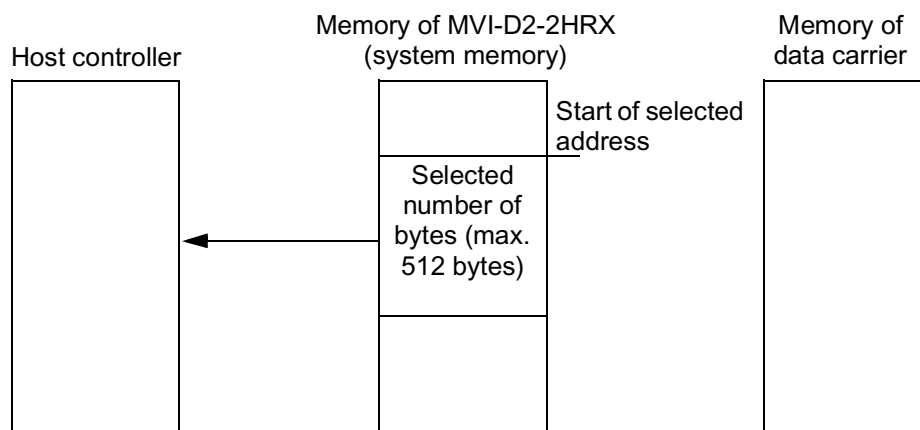
Together with the command "read and check data" from the data carrier to the MVI-D2-2HRX, this command can transmit a multitude of data from a data carrier to a host controller.
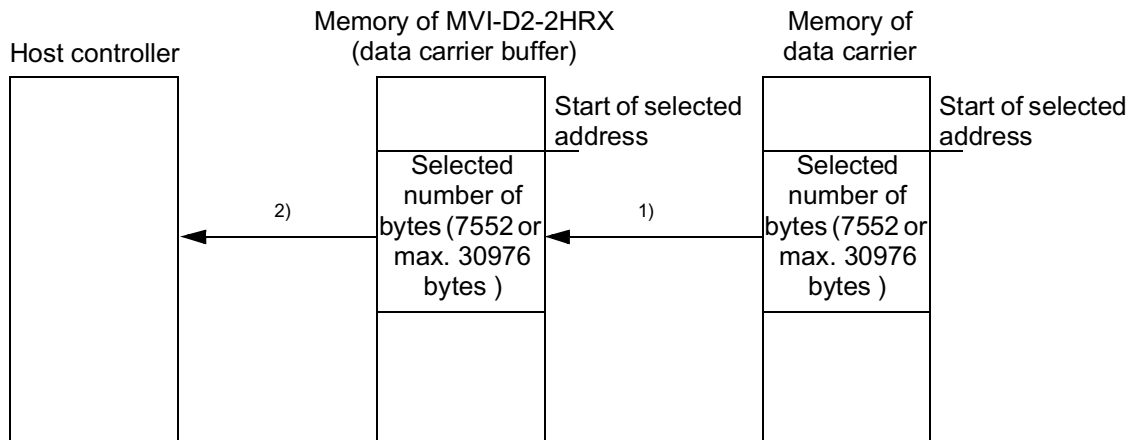
1) Read and check data from a data carrier to an MVI-D2-2HRX (max. 7552 or 30976 bytes).
2) Read data from MVI-D2-2HRX (max. 512 bytes).

Reading the Current Time (Transmission Code: 16$_h$)

This command transmits the time integrated in the MVI-D2-2HRX system memory
(address: A000$_h$ to A0006$_h$, 7 bytes) to the host controller.

Command

:	:	S T A	A N T	?	1	6	D C D	S C (H)	S C (L)	C R

End message

:	:	S T A	A N T	#	1	6	D C D	Year (H)	(L)	Month (H)	(L)	Day (H)	(L)	Weekd (H)	(L)	Hour (H)	(L)	Minute (H)	(L)	Second (H)	(L)	S C (H)	S C (L)	C R

This command reads data from the MVI-D2-2HRX system area regardless of whether
the number of the read/write head command (ANT) is 0 or 1.

Both data formats, hexadecimal: h and JIS: j are available.

Data Value:

Position	Value (BCD)	Notes
Year	00 ... 99	Without digits indicating the century
Month	01 ... 12	
Day	01 ... 31	
Weekday	00 ... 06	Sun - Sat = 00 - 06
Hour	00 ... 23	
Minute	00 ... 59	
Second	00 ... 59	

Data Transmission

Host controller   Memory of MVI-D2-2HRX   Memory of
data carrier

A000$_h$

Time
(7 bytes)   A006$_h$
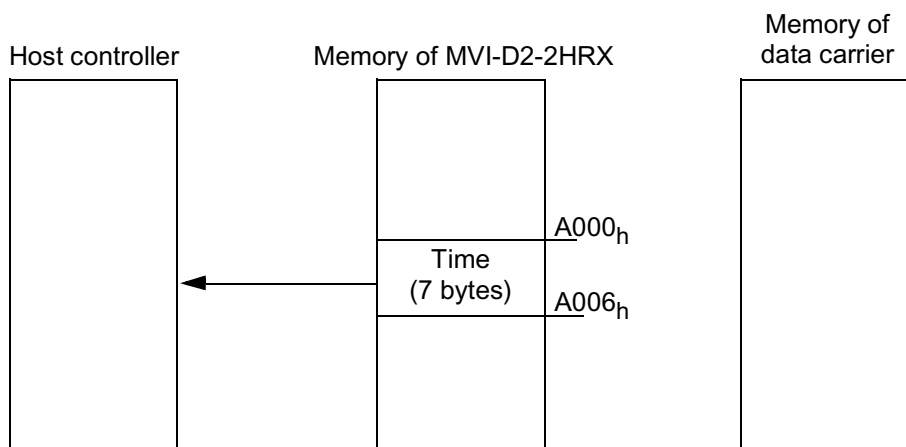
Write (Transmission Code: 20$_h$),

Read and Check (Transmission Code: 21$_h$)

This command transmits data from the host controller to the data carrier memory within the area of a specific starting address with a specific number of bytes. The maximum number of available bytes is 512.

Command
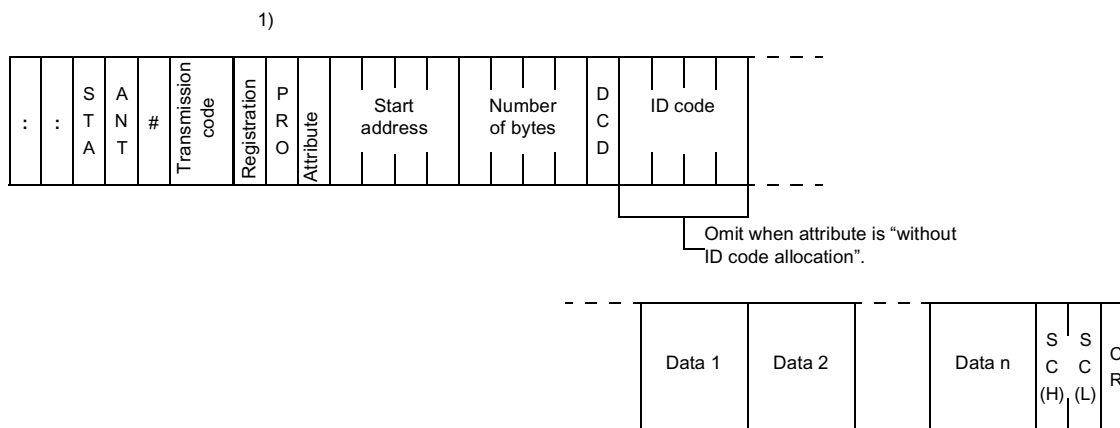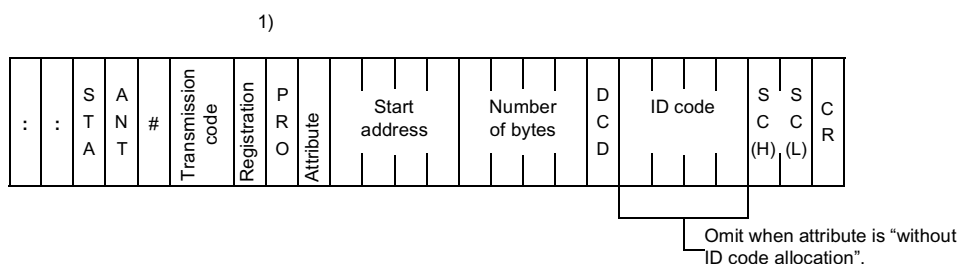
1)

:	:	S T A	A N T	#	Transmission code	Registration	P R O	Attribute	Start address	Number of bytes	D C D	ID code

Omit when attribute is "without ID code allocation".

Data 1	Data 2	Data n	S C (H)	S C (L)	C R

End message

1)

:	:	S T A	A N T	#	Transmission code	Registration	P R O	Attribute	Start address	Number of bytes	D C D	ID code	S C (H)	S C (L)	C R

Omit when attribute is "without ID code allocation".

1) In the case of the occasional execution system, command stay system, or read/write head scan system, this command sets "*" into the command memory. In this setting the command also stores "*" in the end message.

Data Transmission

Host controller

Memory of MVI-D2-2HRX (data carrier buffer)

Start of selected address

Selected number of bytes (max. 512 bytes)

Memory of data carrier

Start of selected address

Selected number of bytes (max. 512 bytes)

Read ID Code (Transmission Code: 22$_h$)

This command writes the ID code from the host controller to the system memory of the data carrier (address: 8040$_h$ to 8043$_h$, 4 bytes).

Note: When the instruction attribute is "ID code allocated function/non-function", a new ID code is appended at the end of the data code (DCD).

Command

:	:	S T A	A N T	?	2	2	Registration ¹⁾	P R O	Attribute	D C D ²⁾		ID code		S C (H)	S C (L)	C R

End message

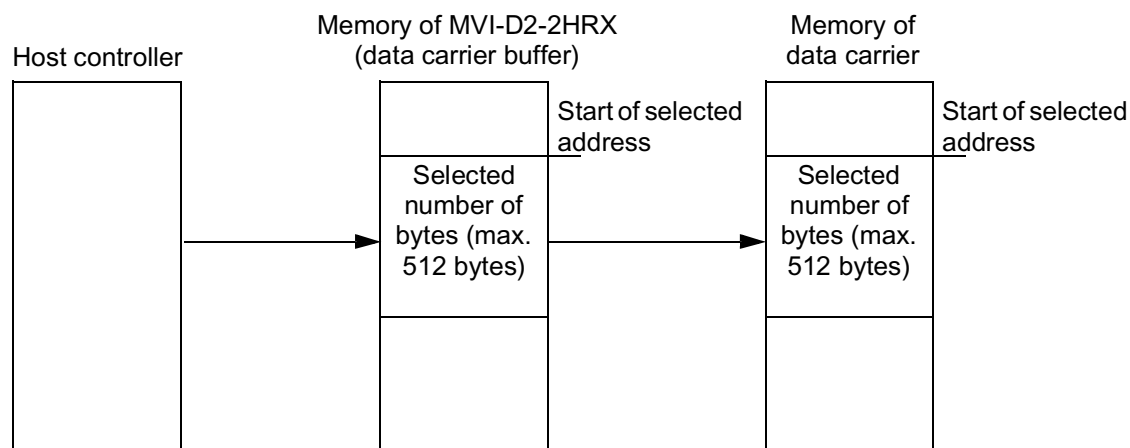| :	:	S T A	A N T	?	2	2	Registration ¹⁾	P R O	Attribute	D C D ²⁾	S C (H)	S C (L)	C R

1) In the case of the occasional execution system, command stay system, or read/write head scan system, this command sets "*" into the command memory. In this setting the command also stores "*" in the end message.

2) Both data formats, hexadecimal: h and JIS: j are available.
   Hexadecimal: 00000000 to FFFFFFFF (8 digits)
   JIS: 4 digits JIS code.

Note: When the instruction attribute is "ID code acknowledgement", a new ID code is appended at the end of the data code (DCD).

Data Transmission

Host controller

Memory of MVI-D2-2HRX (data carrier buffer)

Memory of data carrier

ID code (4 bytes)

8040$_h$

8043$_h$

ID code (4 bytes)

8040$_h$

8043$_h$
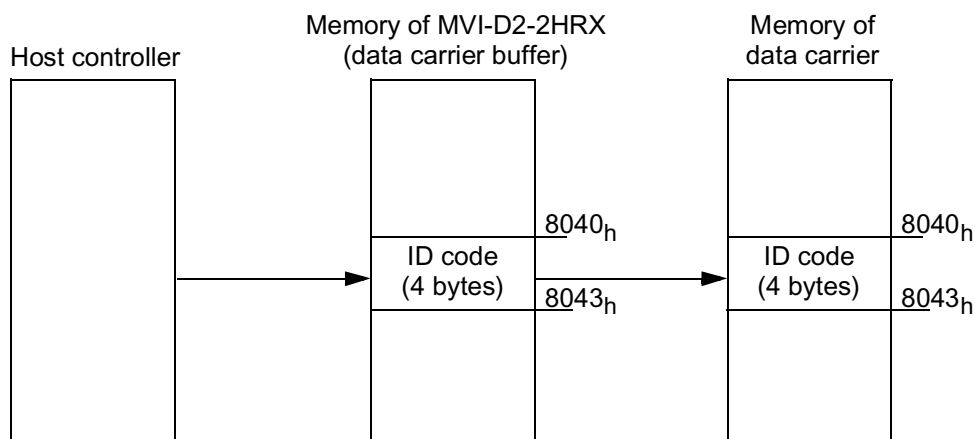
Writing Data into the Data Carrier (Transmission Code: 24$_h$)

These commands transmit data within the MVI-D2-2HRX data carrier buffer from a specific starting address (transmission source data) to another specific starting address in a data carrier using a specified number of bytes. The maximum number of writable bytes is 7552 or 30976.
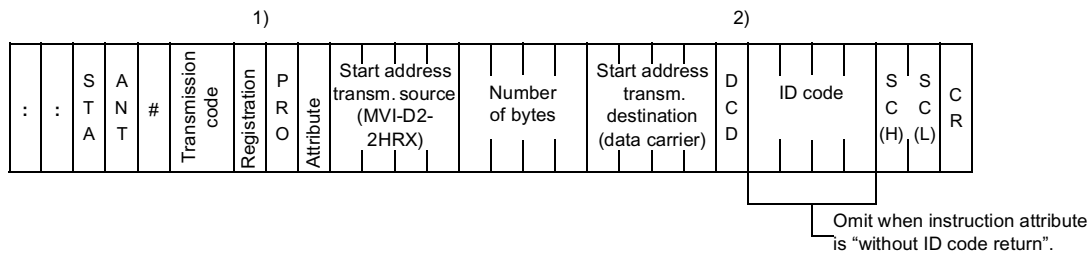
Command

Omit when attribute is "without ID code allocation".

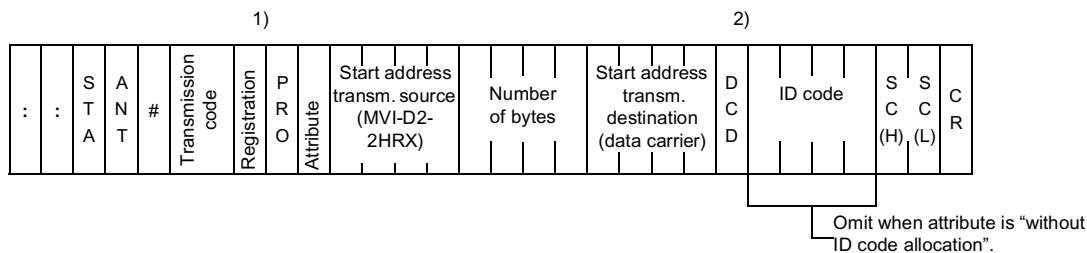End message

Omit when instruction attribute is "without ID code return".

1) In the case of the occasional execution system, command stay system, or read/write head scan system, this command sets "*" into the command memory. In this setting the command also stores "*" in the end message.

2) With the setting "ID code append a message", the data code of the ID code (DCD) is required (hexadecimal: h, JIS: j). When the setting is "without message of the ID code", the command appends "*" to its DCD.

Data Transmission
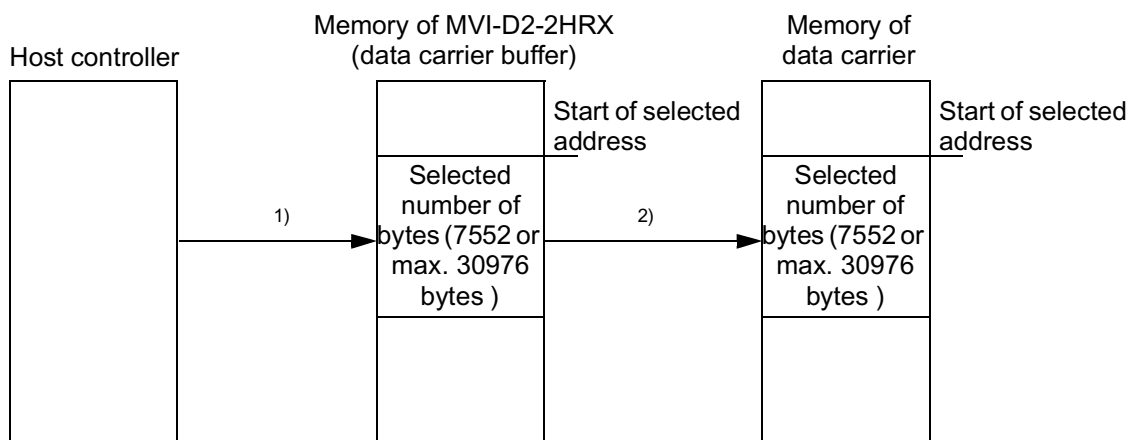
1) Write data to the MVI-D2-2HRX (max. 512 bytes).
2) Write and check data from the MVI-D2-2HRX to the data carrier (max. 7552 or 30976 bytes).

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Writing Data into the Control Interface Unit (Transmission Code: 25$_h$)

Command

:	:	S T A	A N T	?	2	5	Start address transm. source (MVI-D2-2HRX)	Number of bytes	D C D	Data 1	Data 2		Data n	S C (H)	S C (L)	C R

End message

:	:	S T A	A N T	?	2	5	Start address transm. source (MVI-D2-2HRX)	Number of bytes	D C D	S C (H)	S C (L)	C R

When writing data into the MVI-D2-2HRX special area, the command writes data into the system area regardless of whether the number of the read/write head command (ANT) is 0 or 1.

Data Transmission

Writing into the system memory of the control interface unit
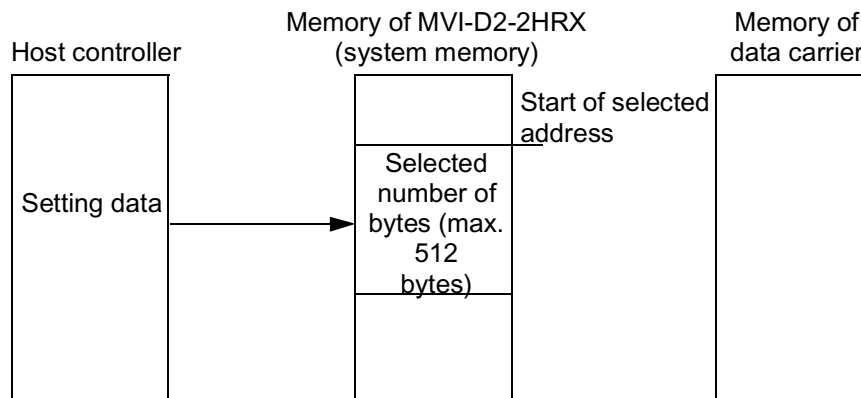
Along with the command "write and check data" from the MVI-D2-2HRX to the data carrier, this command can transmit a multitude of data from the host controller to the data carrier.
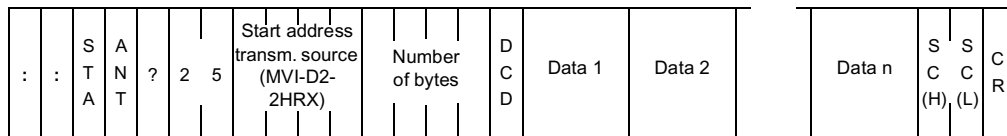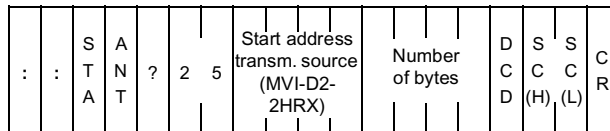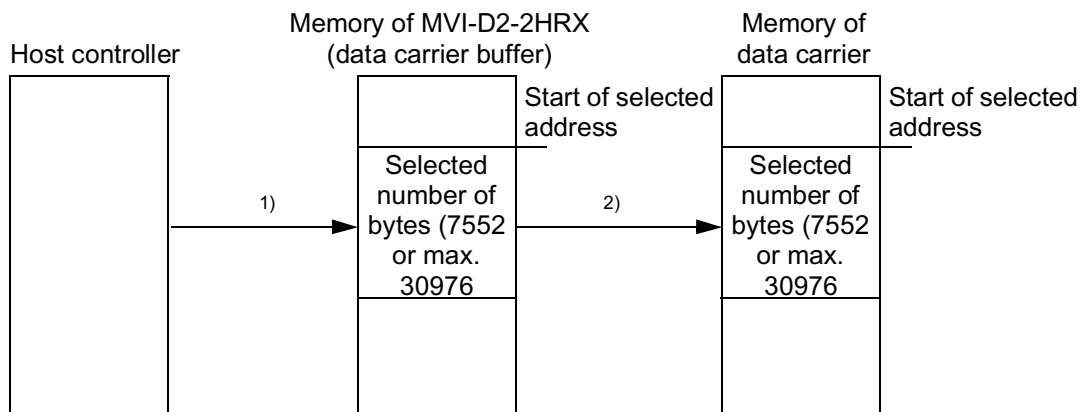

(1) Write data to an MVI-D2-2HRX (max. 512 bytes).
(2) Write and check data from the MVI-D2-2HRX to the data carrier (max. 7552 or 30976 bytes).

Setting the Current Time (Transmission Code: 26$_h$)

This command transmits date and time (year, month, day, weekday, hour, minute and second) from the host controller to the clock integrated in the MVI-D2-2HRX. With this command the data in the MVI-D2-2HRX system memory also changes (address A000$_h$ to A006$_h$, 7 bytes).

Command

:	:	S T A	A N T	?	2	6	D C D	Year		Month		Day		Weekd		Hour		Minute		Second		S C (H)	S C (L)	C R
								(H)	(L)	(H)	(L)	(H)	(L)	(H)	(L)	(H)	(L)	(H)	(L)	(H)	(L)			

End message

:	:	S T A	A N T	?	1	6	D C D	S C (H)	S C (L)	C R

This command writes the time into the same MVI-D2-2HRX special area regardless of whether the number of the read/write head command (ANT) is 0 or 1.

Both data formats, hexadecimal: h and JIS: j are available for the data code (DCD).

Data Value:

Position	Value (BCD)	Notes
Year	00 ... 99	Without digits indicating the century
Month	01 ... 12	
Day	01 ... 31	
Weekday	00 ... 06	Sun - Sat = 00 - 06
Hour	00 ... 23	
Minute	00 ... 59	
Second	00 ... 59	

Data Transmission

Host controller — Time → Memory of MVI-D2-2HRX (system memory): time entry (7 bytes), A000$_h$ to A006$_h$. Memory of data carrier.
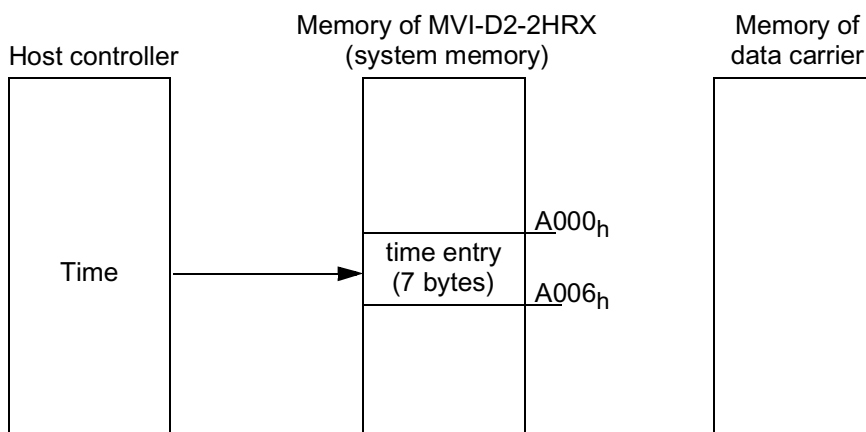
Clear (Transmission Code: 30$_h$)

This command writes the same data from a specific starting address to the memory of the data carrier with a specified number of bytes. The maximum number of erasable bytes is 7552 or 30976.

Command

:	:	S T A	A N T	?	3	0	Registration	P R O	Attribute	Start address	Number of bytes	D C D	ID code	Clear data	S C (H)	S C (L)	C R

1)   2)

Omit when attribute is "without
ID code allocation".

End message

:	:	S T A	A N T	#	3	0	Registration	P R O	Attribute	Start address	Number of bytes	D C D	ID code	Clear data	S C (H)	S C (L)	C R

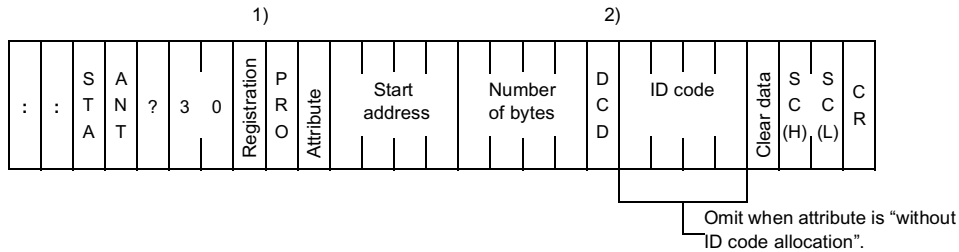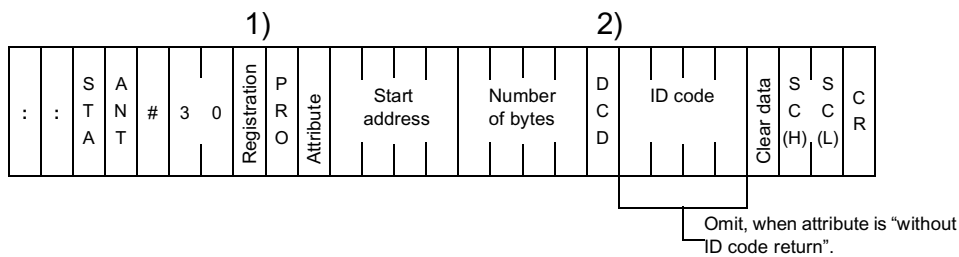1)   2)

Omit, when attribute is "without
ID code return".

1) In the case of the occasional execution system, command stay system, or read/write head scan system, this command sets "*" into the command memory. In this setting the command also stores "*" in the end message.

2) Both data formats, hexadecimal: h and JIS: j are available for the data code (DCD).
Hexadecimal: 00 to FF
JIS: One digit JIS code

Data Transmission

Host controller   Memory of MVI-D2-2HRX   Memory of
                         (data carrier buffer)   data carrier

Clear data   Start address
(1 byte)   Specific
                                                        number of
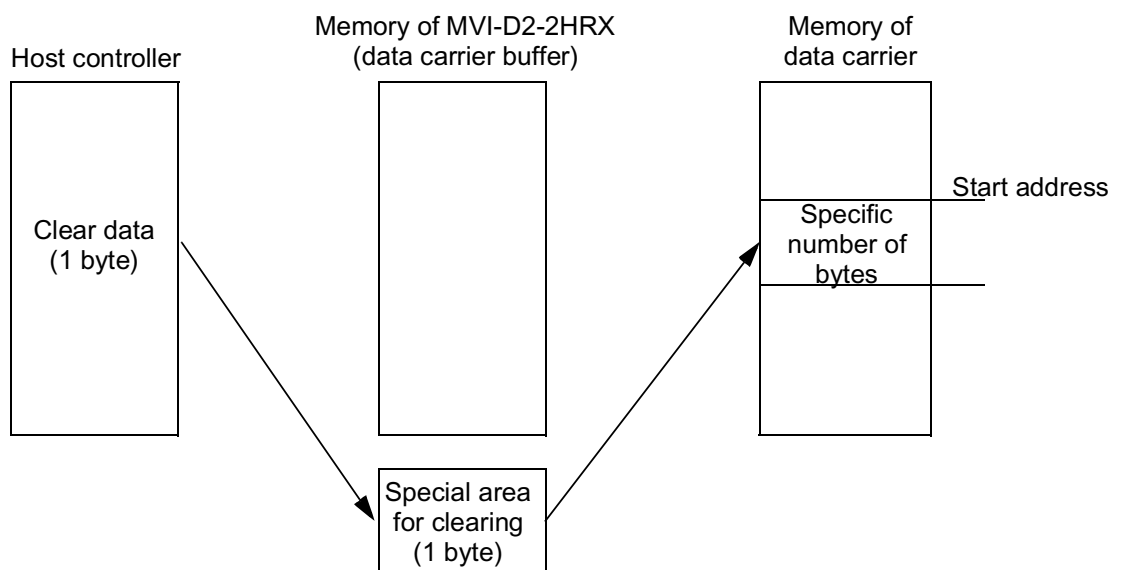   bytes

                         Special area
                         for clearing
                         (1 byte)

Note: When executing the clear command, the data carrier buffer of the MVI-D2-2HRX is not changed.

Initialise Data Carrier (Transmission Code: 31$_h$)

This command initialises the entire memory area of the data carrier.

- Data area: 00$_h$, system area: initial values.

- This command also clears the setting of the system memory protection in the data carrier.

Command

Omit when attribute is "without ID code allocation".

End message

Omit, when attribute is "without ID code return".
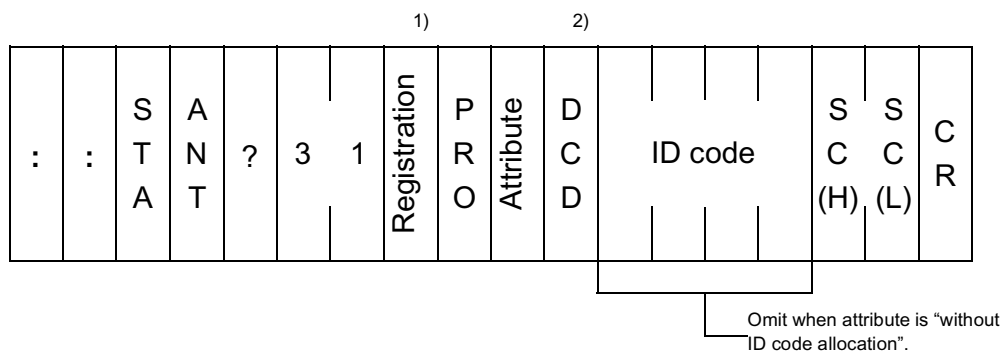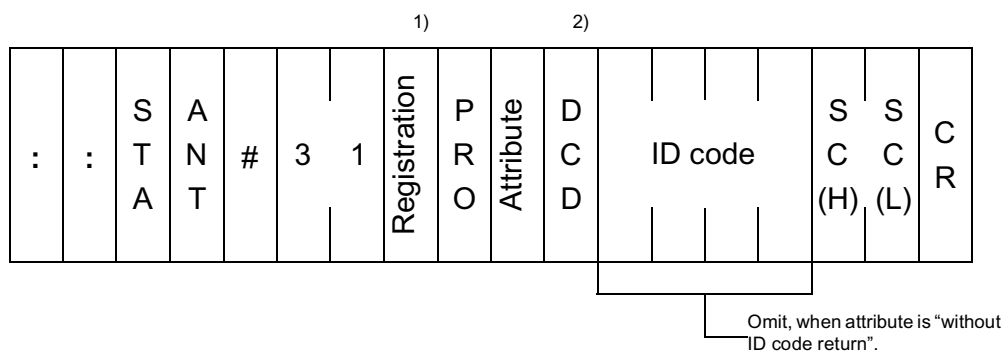
1) In the occasional execution system, command stay system, or read/write head scan system, this command sets "*" into the command memory. In this setting the command also stores "*" in the end message.

2) Data code (DCD) must be set for the ID code (hexadecimal: h, JIS: j).

Clearing the Data of the Control Interface Unit (Transmission Code: 35$_h$)

This command writes the same data from a specific starting address of the MVI-D2-2HRX memory (data carrier buffer and system memory) with a specific number of bytes. The maximum number of erasable bytes is 7552 or 30976.

Command

:	:	S T A	A N T	?	3	5	Registration	P R O	Attribute	Start address			Number of bytes			D C D	Clear data	S C C (H)	S C C (L)	C R

End message

:	:	S T A	A N T	?	3	5	Registration	P R O	Attribute	Start address			Number of bytes			D C D	S C C (H)	S C C (L)	C R

- When clearing the MVI-D2-2HRX system area, this command clears the same area regardless of whether the number of the read/write head command (ANT) is 0 or 1.

- Both data formats, hexadecimal: h and JIS: j are available for the data code (DCD).

- Clear data
  hexadecimal: 00 to FF
  JIS: One digit JIS code
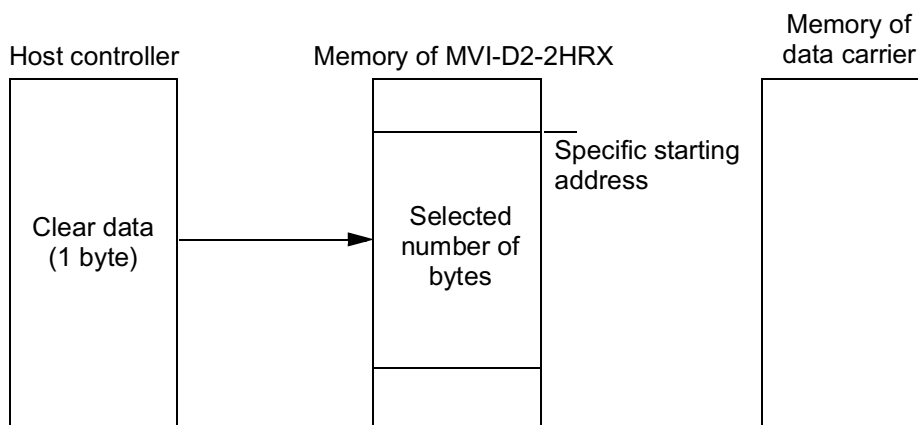
Data Transmission

Initialisation of MVI-D2-2HRX (Transmission Code: 36$_h$)

This command initialises the data of the entire MVI-D2-2HRX system memory. It also resets the transmission time protocol, the number of the transmission protocol as well as the error protocol.

Command

:	:	S T A	A N T	?	3	6	S C (H)	S C (L)	C R

End message

:	:	S T A	A N T	#	3	6	S C (H)	S C (L)	C R

The MVI-D2-2HRX system area is initialised regardless of whether the number of the read/write head command (ANT) is 0, 1 or *.

Clear Protocol (Transmission Code: 37$_h$)

This command clears the transmission time protocol, the number of the transmission protocol as well as the error protocol of the MVI-D2-2HRX system memory.

- Selectable initialisation area of the transmission time protocol, the number of the transmission protocol or the error protocol.

- Selectable areas (for each read/write head)

  1. Transmission time protocol:
     Starting address 90A0$_h$, 20 bytes

  2. Number of the transmission protocol:
     Starting address 90C0$_h$, 8 bytes

  3. Error protocol:
     Starting address 9100$_h$, 3202 bytes

Command

		S T A	A N T	?	3	7	Area	S C C (H)	S C C (L)	C R
:	:									

1) Select area to initialise
   0 = Transmission time protocol
   1 = Number of transmission protocol
   2 = Error protocol

End message

		S T A	A N T	#	3	7	S C C (H)	S C C (L)	C R
:	:								

Copy

Copy Data between Different Read/Write Heads
(Transmission Code: 40$_h$)

Copy and Check Data between Different Read/Write Heads
(Transmission Code: 41$_h$)

This command reads data within a specific memory area of the data carrier (copy source), which is located in the communication area of the read/write head and writes into the memory of the data carrier (copy destination) which is located in the communication area of the other read/write head.

Specify the number of the copy source's read/write head in the command as number of the read/write head (ANT). (ANT = 0 corresponds to copying data from read/write head 0 to read/write head 1. ANT = 1 corresponds to copying data from read/write head 1 to read/write head 0.)

The maximum number of bytes that can be copied is 7552 or 30976.

Note: This copy command cannot be used when the read/write head scan system is in normal operation.

Command

End message

1) In the case of the occasional execution system or command stay system, this command sets "*" into the command memory. In this setting the command stores "*" in the end message.

2) Set the protection setting for the copy destination in the data carrier (PRO).

3) The data code (DCD) should be set for the ID code (hexadecimal: h, JIS: j).

4) When the attribute is set to "ID code allocated function/non-function", the ID code of the copy destination, the data carrier, is to be set in this area. When the attribute is set to "without ID code allocation", omit this setting.

5) When the attribute is set to "ID code with acknowledgement", the ID code of the copy destination, i.e. the data carrier, is returned to this area. When the attribute is set to "without ID code allocation", this area is omitted.

Writing start method of copy commands

1. Occasional execution system: Start writing after end of reading (automatic writing of the MVI-D2-2HRX).

2. Command stay system or command register system: Writing starts with the trigger input of the writing read/write head.

In case data is copied in the occasional execution system and by the instruction of the host controller.
Read: Read and check data from the data carrier to the MVI-D2-2HRX.
Write: Write and check data from the MVI-D2-2HRX to the data carrier.

Data Transmission

Copy and check data between read/write heads.

Host controller

Memory of MVI-D2-2HRX
(data carrier buffer)

Memory of data carrier in
front of read/write head
containing the source data

Start
address

Selected
number of
bytes

Start
address

Selected
number of
bytes

Memory of data carrier in
front of read/write head for
the target data

Start
address

Selected
number of
bytes
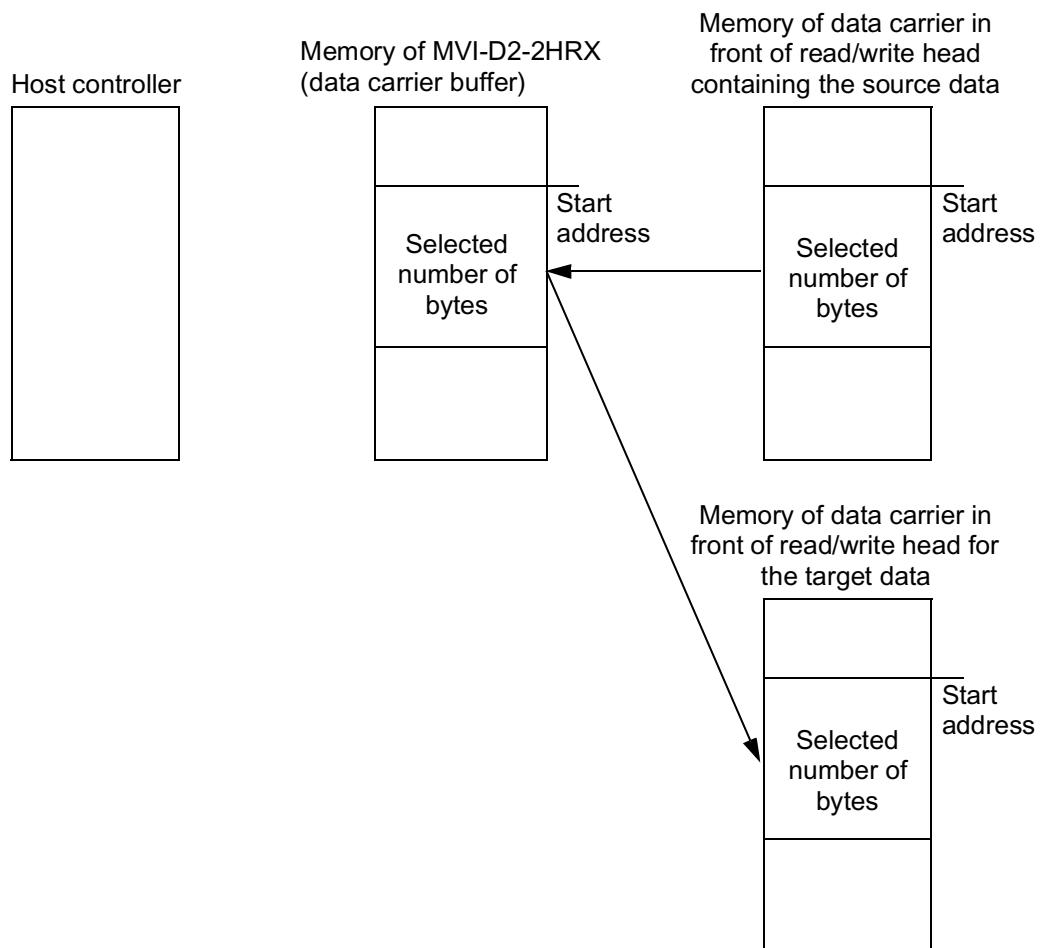
Data Transmission

When copying and checking data with the read/write head in the occasional execution system.


```
        Host controller          Memory of MVI-D2-2HRX      Memory of data carrier in
                                 (data carrier buffer)      front of read/write head
                                                            containing the source data
```

(1) Read: Read and check data from the data carrier to the MVI-D2-2HRX
(2) Write: Write and check data from the MVI-D2-2HRX to the data carrier.

Diagnostic Commands

Five types of diagnostic functions are available in accordance with the contents of the settings and the messages.

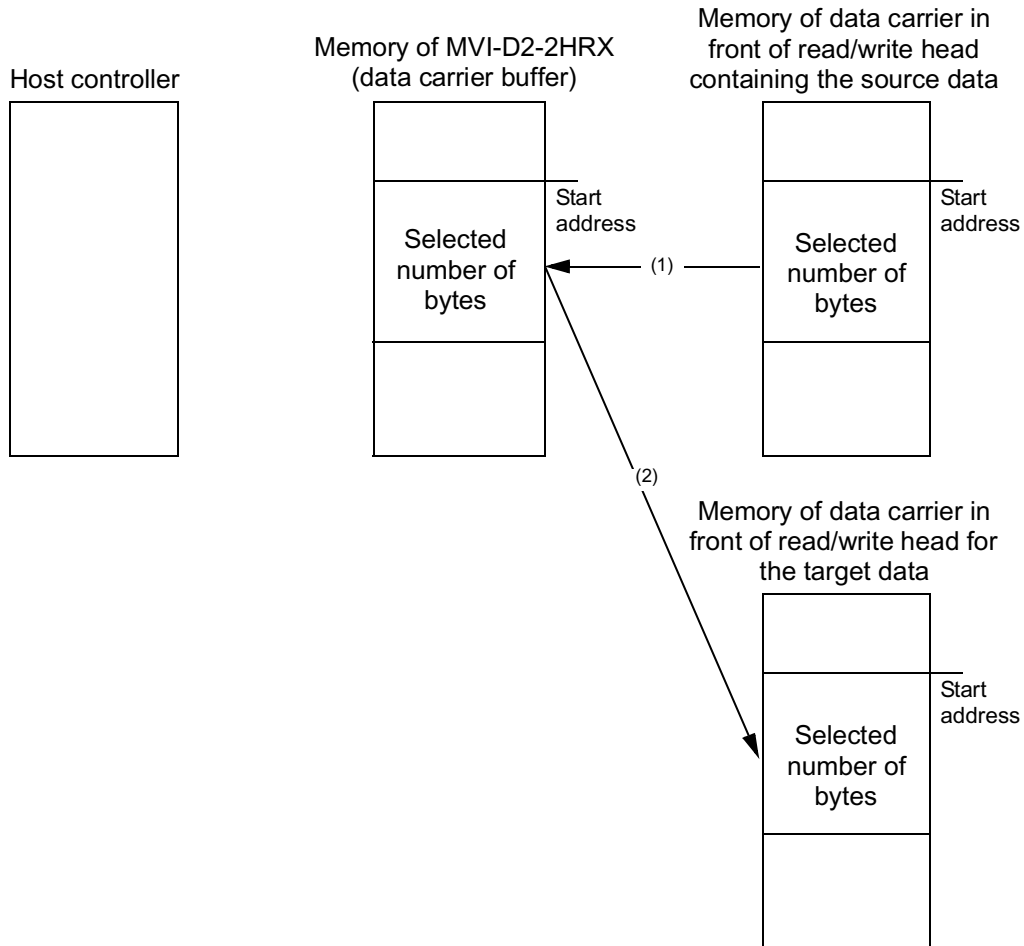1. Self-diagnosis of data carrier (50_h)
2. RAM check (52_h), block check (60_h)
3. ROM check (51_h)
4. Battery life check of data carrier (53_h)
5. Self-diagnosis of MVI-D2-2HRX (55_h)

The values in brackets constitute the transmission codes.

Self-Diagnosis of the Data Carrier (Transmission Code: 50h)

The data carrier diagnoses independently whether CPU, ROM, RAM and battery life are normal.

- The setting range in this command is the RAM check range. When the range is not set, the command performs a ROM check and a battery check.

- The maximum number of bytes that can be diagnosed is 7552 or 30976.

Command
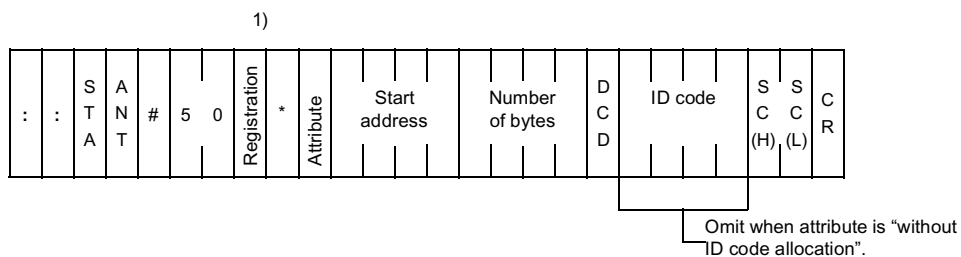
End message (When diagnostic result is normal)
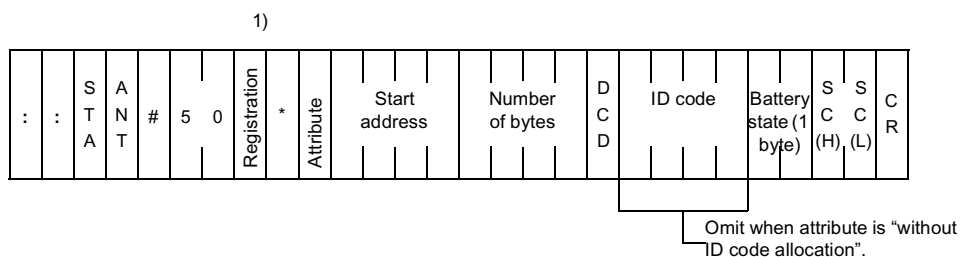
1) In the case of the occasional execution system or command stay system, this command sets "*" into the command memory. In this setting the command stores "*" in the end message.

When the number of bytes is 0000_h, this command does not perform a RAM check. The diagnostic command does only perform the ROM check and the battery life check.

- The command checks the whole area (data memory and system memory), when both starting addresses and the number of bytes are set to "****".

- When the number of bytes is set to "****" this command checks the whole area of the starting address.

- When an error is found using the diagnostic, the MVI-D2-2HRX sends an error message including the test of the battery service life.

RAM Check (Transmission Code: 52$_h$)

Block Check (Transmission Code: 60$_h$)

- RAM check: Checks whether the RAM in the data carrier works normally.

- Block check: Checks whether data written in the data carrier was not changed by anything other than write instructions.

- The maximum number of bytes that can be diagnosed is 7552 or 30976.

- The command checks the whole area (data memory and system memory), when both starting addresses and the number of bytes are set to "****".

- When an error is found in the diagnosis, the data carrier returns an error message.

Command

Omit when attribute is "without ID code allocation".
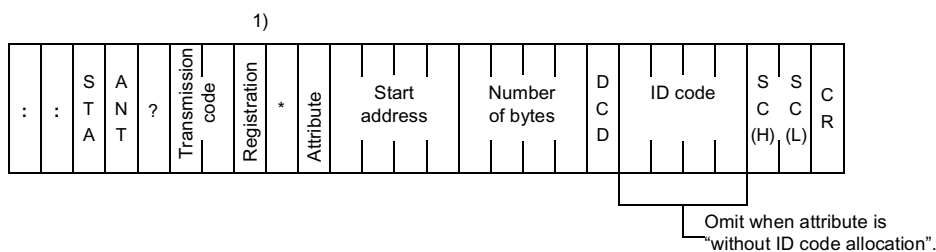
End message (when the data is normal)
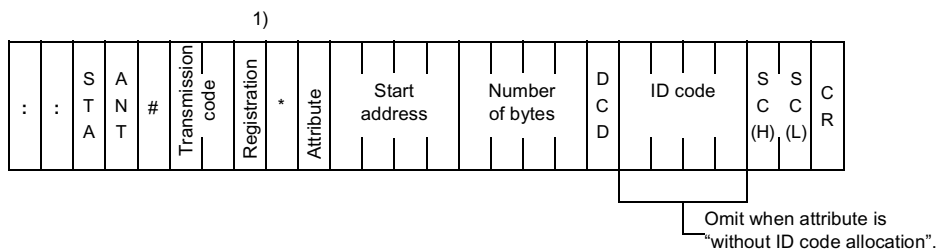
Omit when attribute is "without ID code allocation".

1) In the case of the occasional execution system or command stay system, this command sets "*" into the command memory. In this setting the command stores "*" in the end message.

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ROM Check (Transmission Code: 51$_h$)

This command diagnoses whether the ROM in the data carrier functions properly.

Command

Omit when attribute is
"without ID code allocation".

End message (when diagnostic result is normal)

Omit when attribute is
"without ID code allocation".

1) In the case of the occasional execution system or command stay system, this command sets "*" into the command memory. In this setting the command stores "*" in the end message.

When an error is found using the diagnostic, the data carrier returns an error message.

Data Carrier's Battery Life Check)
(Transmission Code: 53$_h$)

This command checks the life span of the battery in the data carrier. The command diagnoses the battery voltage and the battery service life for test purposes.

Command
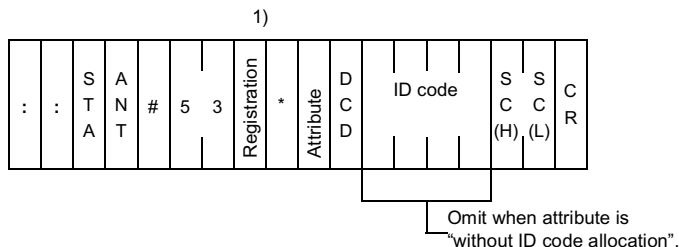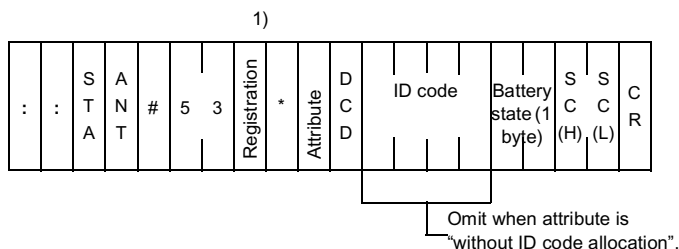
:	:	S T A	A N T	#	5	3	Registration	*	Attribute	D C D	ID code	S C (H)	S C (L)	C R

1)

Omit when attribute is "without ID code allocation".

End message (when diagnostic result is normal)

:	:	S T A	A N T	#	5	3	Registration	*	Attribute	D C D	ID code	Battery state (1 byte)	S C (H)	S C (L)	C R

1)

Omit when attribute is "without ID code allocation".

1) In the case of the occasional execution system or command stay system, this command sets "*" into the command memory. In this setting the command stores "*" in the end message.

When an error is found using the diagnostic, the data carrier sends an error message including the value of the battery service life.
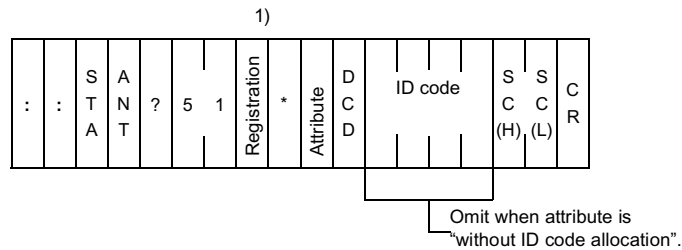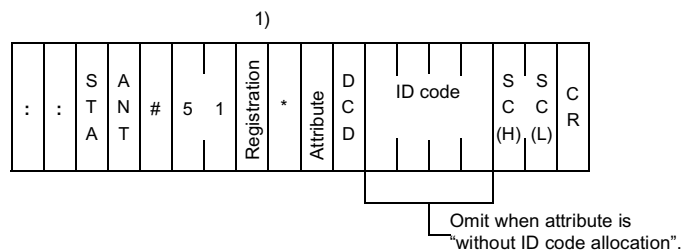
Self-Diagnosis of the MVI-D2-2HRX (Transmission Code: 55$_h$)

This command checks whether ROM and RAM function properly and whether the batteries still have enough voltage.

Command

:	:	S T A	A N T	?	5	5	S C (H)	S C (L)	C R

1)
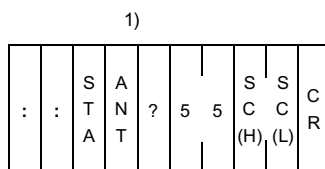
1) This command is available, regardless of whether the read/write head (ANT) is set to 0, 1 or *.

End message (when diagnostic result is normal)
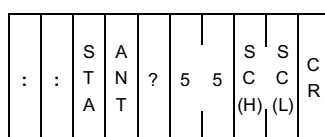
:	:	S T A	A N T	?	5	5	S C (H)	S C (L)	C R

When an error is found using the diagnostic, the MVI-D2-2HRX sends an error message.

Other Functions

Reset (Transmission Code: 70$_h$)

- Stops the current execution of a command.

- This command clears the error condition of the MVI-D2-2HRX (switches OFF the error indication LED).

Command

:	:	S T A	A N T	?	7	0	S C (H)	S C (L)	C R

ANT	Reset of the read/write head
0	0
1	1
*	0, 1 (both)

End message

:	:	S T A	A N T	?	7	0	S C (H)	S C (L)	C R
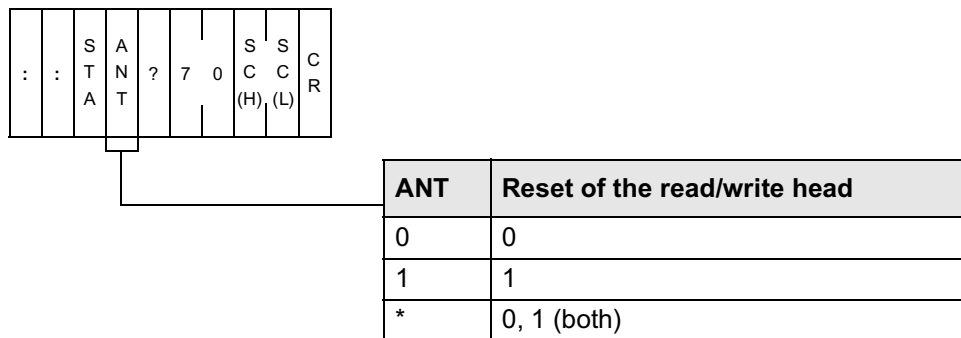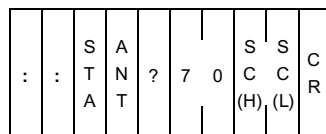
Result Request (Transmission Code: 71$_h$)

This command requests the function result to be sent (end message or error message) from the response request system.

Message contents

1. When the MVI-D2-2HRX has ended the instruction execution, it sends the end message of the command.

2. When the MVI-D2-2HRX still executes the command, it sends the end message of the "result request".

Command

:	:	S T A	A N T	?	7	1	S C (H)	S C (L)	C R
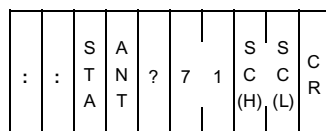
End message (when the MVI-D2-2HRX still operates)

:	:	S T A	A N T	#	7	1	S C (H)	S C (L)	C R
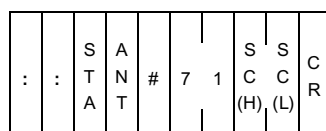
Output Instruction (Transmission Code: 72$_h$)

This command switches outputs 0 to 3 of the MVI-D2-2HRX ON or OFF. This command is available for the function regardless of whether the setting of the read/write head (ANT) is 0, 1 or *.

Command

Set outputs: 0 = OFF; 1 = ON

End message

Read Status (Transmission Code: 73$_h$)

This command reads the status of the MVI-D2-2HRX.

Command

End message

Status	Description
0	Wait for trigger input
1	Wait for command
2	Data carrier access
3	Data carrier error
4	Wait for end of operation of the opposite read/write head (when copying data between the read/write heads)
5	Search for a data carrier
6	Another station accesses the data carrier (read/write head scan function)

Stop Function (Transmission Code: 74$_h$)

- This command stops the transmission function in the MVI-D2-2HRX using the command register system (startup system: A008$_h$= 2). In this case, the MVI-D2-2HRX does not execute the stored function by switching ON the trigger input. (Instruction for the stored function: 9010$_h$= 0)

- This command inevitably stops the transmission function during the read/write head scan.

- This command is only available when "*" is set as read/write head (ANT).

Command

:	:	S T A	A N T	?	7	4	S C (H)	S C (L)	C R

End message

:	:	S T A	A N T	#	7	4	S C (H)	S C (L)	C R

Command when Trigger Input is ON (Transmission Code: 75$_h$)

- When the trigger input is switched ON, the command executes the command stored under the storage number (command register system: A008$_h$=2).

- This command sets the memory contents of the address 9010$_h$ in the system area of the respective data carrier.

Command

:	:	S T A	A N T	#	7	5	Register No	S C (H)	S C (L)	C R

Storage number of the command, when the trigger input is ON.

End message
End message of the stored command.

Start of the Next Command (Transmission Code: 76$_h$)

This command enables the stored command to be executed when the trigger input in the command register system is ON (Startup system: A008$_h$= 2). (The storage number should be executed after the transmission function, which is triggered by the command to start the function (transmission code: 75$_h$)).

Conditions for executing the command:

1. Executes the stored function number at the function start (transmission code: 75$_h$).

2. The MVI-D2-2HRX trigger input is set to ON.

Command

:	:	S T A	A N T	?	7	6	Register No	S C (H)	S C (L)	C R

End message
End message of the stored command.

Re-execution (Transmission Code: 77$_h$)

This command initiates the re-execution of the transmission function by the command register system (startup system: A008$_h$= 2). The command is used when the message of the MVI-D2-2HRX contains a mistake. By means of this command the MVI-D2-2HRX executes the previously executed command.

Command

:	:	S T A	A N T	?	7	7	S C (H)	S C (L)	C R

End message
End message of the stored command.

9.4.5 Example for Application of the "Single Read" Mode

Transmission with a Stopped Data Carrier

(Communication startup system: Command stay system)

This method is the most reliable transmission method, since the position of the data carrier in relation to the read/write head is fixed.

1. The commands from the host controller to the MVI-D2-2HRX are stored in advance.
2. The data carrier must be mounted on the pallet so that it can be transported with the conveyor device.
3. When the pallet reaches the calculated position, the pallet recognition switch is activated and switches the MVI-D2-2HRX trigger input ON. The pallet is stopped by a stopper.
4. With the pallet arrival signal, the read/write head starts communication with the data carrier.

The optimum condition is when the data carrier and the read/write head face each other directly in the stop position.

If the pallet is stopped only by a stopper, it may move backwards during the transmission procedure, and the data carrier on the pallet may come outside the transmission area of the read/write head. Therefore, a stopper is required in order to prevent the pallet from moving backwards.

Transmission with a Moving Data Carrier

(Communication startup system, command stay system).

This system is suitable for mounting parts, which are moving on the belt conveyor. The system shortens the clock time.

1. The transmission commands from the host controller to the MVI-D2-2HRX are stored in advance.
2. The data carrier must be mounted on the pallet so that it can be transported with the conveyor device.
3. Install proximity switches just before each arrival position at the work place. After the proximity switch has responded, switch the trigger input ON (the data carrier should be within the transmission area of the read/write head).
4. On arrival of the proximity switch signal, the read/write head starts communication with the data carrier.
5. Before the pallet reaches the working station, the read/write head should already have finished exchanging data with the data carrier.

The transmission should be completed before the data carrier comes out of reach of the read/write head's transmission area. In order to provide sufficient tolerance to complete the transmission, the relation between the data carrier movement and the required transmission time to the data carrier (including retry time interval in the case of a transmission error) must be taken into account. Then the time-limit for the transmission has to be set in the memory address 9000_h of the MVI-D2-2HRX.

(Example for transmission with a moving data carrier)

1. The proximity switch detects the pallet (data carrier), which passes position **A** (within the transmission area) and switches the trigger input ON in order to start the transmission.

2. The read/write head ends the transmission before the pallet passes position **B**.

3. Place the working station after position **B**.

Proximity switch

Target

Moving direction

Pallet

A

B

Data carrier

Transmission area
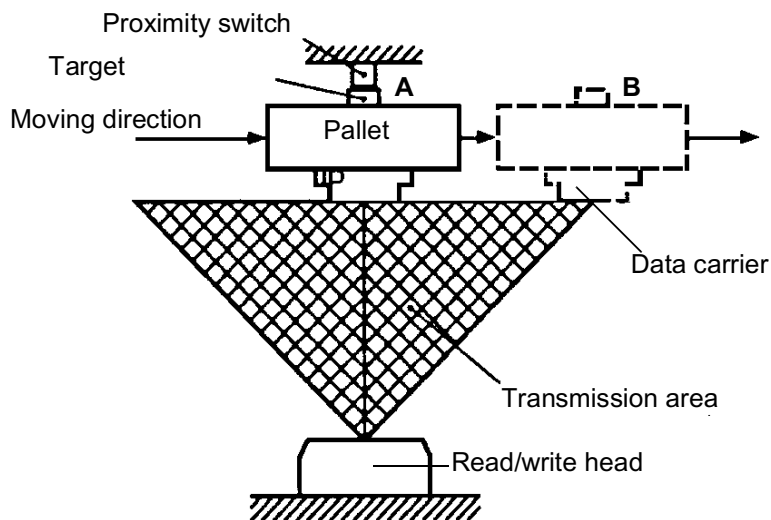
Read/write head

9.4.6 Example for the Use of the "Auto Read" Mode with Unlimited Data Carrier Detection Time

The timer starts the transmission:

1. When the data carrier enters the transmission area, the read/write head automatically starts the transmission to the data carrier.

2. On execution of the transmission, the host controller starts the time-counter.

3. After a specific interval has passed (time out), the MVI-D2-2HRX automatically starts the next transmission in the "auto read" mode.

The previous data carrier should come out of the transmission area of the read/write head before timeout is reached. Set the previous data carrier's ID code to "ID code allocated non-function".

Arrange in such a way, that the next data carrier does not come out of the transmission area while the timer is still counting.

The rate of motion of the data carrier (workpiece or pallet) should be consistent.

In the Case of a Continuous Start

While the transmission conditions are met, always set to "auto read".

The timer starts the transmission:

1. The automatic function start signal of the device, starts the first transmission using the "auto read" function.

2. When the data carrier enters the transmission area, the read/write head automatically starts the transmission to the data carrier.

3. After the transmission is completed, the system starts the next transmission in the "auto read" mode.

The system should be arranged in such a way that no problem occurs when a transmission is performed more than once with the same data carrier. When problems occur during repeated transmissions, ID codes for each data carrier should be written. Execute the function with "ID code allocated non-function".

This function is even available when the speed of the data carrier (workpiece, pallet etc.) varies. In the case of a conditional start, the system starts the transmission in the "auto read" mode with a specific signal (specific condition).

1. The system starts communication with "auto read" by means of the pallet scan signal.

2. When the data carrier enters the transmission area, the read/write head automatically starts the transmission to the data carriers.

3. After the transmission is completed, the system ends "auto read" and waits for the next pallet scan signal.

The previous data carrier should come out of the read/write head's transmission area before the pallet scan signal is entered. Set the previous data carrier's ID code as "ID code allocated non-function".

This function is also available when the speed of the data carrier (pallet etc.) varies (example of a conditional start).

1. The read/write head starts the transmission with "auto read", after the pallet has passed the signal on position A.

2. When the data carrier enters the transmission area, the system starts the transmission.

3. The read/write head ends the transmission before the pallet passes position C.

4. Place the working station after position C.

Notes

- In the "auto read" mode the read/write head keeps sending signals in order to detect data carriers.

- In the case of "auto read", the transmission can be stopped by receiving "reset command" from the host controller.

- The data carrier's rate of motion is limited.
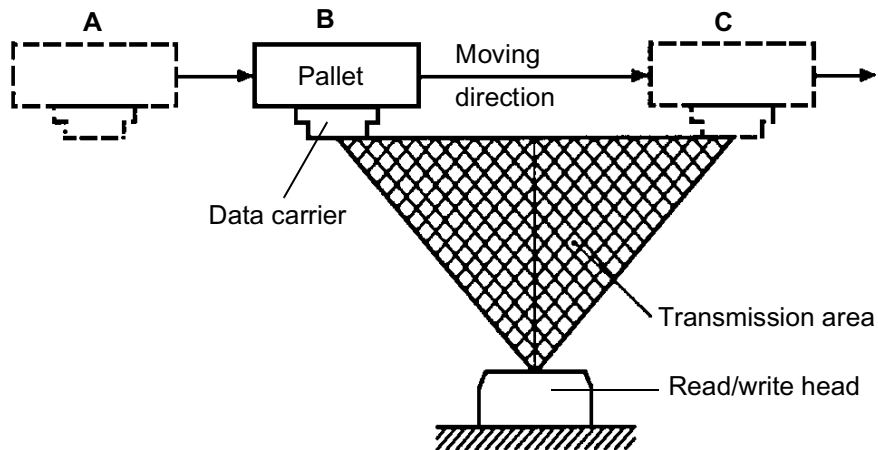
10 Fault Diagnostics

In General

If a command is terminated normally, the MVI-D2-2HRX sends an "acknowledgement" and the "end message" to the host controller. The MVI-D2-2HRX sends an "error message" to the host controller if a command error or a transfer error occurs.

Error Message

The MVI-D2-2HRX displays an "error message" if an error occurs, otherwise it displays an "acknowledgement" or the "end message".

:	:	S T A	A N T	%	$EK_{(H)}$	$EK_{(L)}$	$EK_{(H)}$	$EK_{(L)}$	Error informa- tion	$SC_{(H)}$	$SC_{(L)}$	C R
					Error position		Error code					

Description of the Error Position

00_h: Error between host controller and MVI-D2-2HRX
10_h: Error between MVI-D2-2HRX and read/write head 0
11_h: Error between MVI-D2-2HRX and read/write head 1
12_h: Error when accessing MVI-D2-2HRX

Error codes and Error information see page 180.

The "error message" will be transmitted in two positions: in the "acknowledgement" or in the "end message" dependent on the conditions of the respective commands.

10.1 Trouble Shooting

In case of errors between the host controller and the MVI-D2-2HRX, the errors can be released automatically by a command signal from the host controller.
→ Error LED (ER) turns OFF.

In case of errors at communication between the MVI-D2-2HRX and the read/write head 0, between the MVI-D2-2HRX and the read/write head 1 or during the access operation of the MVI-D2-2HRX, the errors can be released by "reset command".
→ Error LED (ER) turns OFF.

Error LED

Error LED (ER) turns ON upon sending "error message".

Error LED (ER) turns OFF upon releasing the error.

The command "output instruction" (see page 170) from the host controller can be used as error output.
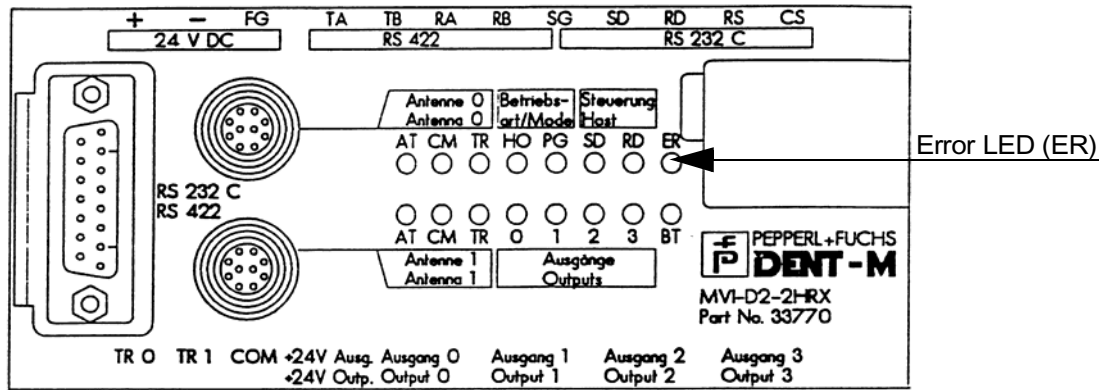
10.2 Error Code

Among error attached information, anything other than the specified contents will be displayed as "*". In case of errors having no error attached information, 12 bytes of "*" will be inserted.

:	:	S T A	A N T	%	EK(H)	EK(L)	EK(H)	EK(L)	Error information	SC(H)	SC(L)	C R
					Error position		Error code		12 digits			

These footnotes are listed under the following error code table:

a) Host controller response
   Acknowledgement: Errors occur by "acknowledgement".
   End: Errors occur by "end message".
b) Error position (EK)
   00_h: Error between host controller and MVI-D2-2HRX
   10_h: Error between MVI-D2-2HRX and read/write head 0
   11_h: Error between MVI-D2-2HRX and read/write head 1
   12_h: Error when accessing MVI-D2-2HRX
c) If a command for self diagnostic or battery life check is executed, the MVI-D2-2HRX executes error processing (in case the error occurs with another command, the error message from a normal end message is attached to this other command).

Table of Error Codes

Error classi-fication	Error code (EC)	Error name	Contents	Host controller response [a]	Error position (EK) [b]
Error during setting	10	Transmission error	Incorrect transmission code	Acknowledge	00
	11	Attribute error	Incorrect attribute code	Acknowledge	00
	12	Top address error	Incorrect top address value	Acknowledge	00
				End	1*
	13	Number of bytes error	Incorrect number of bytes	Acknowledge	00
				End	1*
	14	Transfer destination top address error	Incorrect transfer destination Top address value	Acknowledge	00
	15	Station number error	Value set other than "0" at "read/write head scan" (read/write head number = "*")	Acknowledge	00
	16	Read/write head error	Incorrect read/write head number setting. Ex.: Set "*" in the read/write head scan MVI-D2-2HRX access function.	Acknowledge	00
	17	Command designation error	Incorrect command code (not "?") used.	Acknowledge	00
	18	Protection error	Tried to write data onto the write protected area.	End	1*
	19	Data code error	Incorrect data code "DCD" value. Incorrect write or clear set data. Incorrect clock time setting.	Acknowledge	00
	1A	Operation register error	Set other than "1" to "8" for operation register.	Acknowledge	00
	1B	Protect setting error	Set other than "1" to "A" or "*" for protect setting.	Acknowledge	0
				End	1*
	1C	Selection code error	Incorrect selection code setting of "history clear command" or output instruction command.	Acknowledge	00
	1D	Checksum error 1	Set other than "0 to F or @" in checksum code. Insufficient number of digits in checksum.	Acknowledge	00
	1E	Checksum error 2	Although two digits between 0 and F are existing in the checksum code, the set value is not correct.	Acknowledge	00
	1F	CR error	CR missing.	Acknowledge	00
Error of MVI-D2-2HRX	20	No read/write head 0 connection	Read/write head is not connected.	End	1*
	21	No read/write head 1 connection	Extension cable not connected.		1*
	25	RAM error	RAM error of MVI-D2-2HRX.		12
	26	ROM error	ROM error of MVI-D2-2HRX.		12
	27	Battery voltage low alarm[c]	Voltage error of the integrated battery in MVI-D2-2HRX.		12
Errors of data carrier	30	RAM error	RAM error of a data carrier within the RAM check range.	End	1*
	31	ROM error	ROM error of data carrier		
	34	Block check error	Data inside a data carrier is changed due to an external cause at reading or generating checksum.		

Error classi-fication	Error code (EC)	Error name	Contents	Host controller response [a]	Error position (EK) [b]
Transfer error between read/write head and data carrier	35	Copy destination block checksum error	Data inside the data carrier will be changed due to an external influence during reading the destination data.	End	1*
	36	ID verify error	Verify error between assigned and received ID Code for ID Code operations.		
	37	Copy destination ID verify error	Verify error between assigned and received ID Code for the received ID Code.		
	3A	Battery low voltage alarm	Error message at low battery voltage of integrated battery in data carrier.		
	3B	Battery use ratio alarm 3*	Battery use ratio exceeds 100 %.		
	40	No data carrier	No data carrier exists in the communication area of the read/write head. No ID Code exists in the communication area of the read/write head, which was assigned by the ID Code command.		
	41	Error of serial communication	Parity error, overflow error or frame error.		
Communication error between read/write head and data carrier	42	Last received data timeout error		End	1*
	43	Byte counter error	Error of byte counter code.		
	44	Checksum error			
	45	Grammatical error	Code error on transfer message.		
	46	Limited time over			
	47	Verify error	Data verify error in an operation with verify.		
	48	No data carrier error at copy destination	No data carrier exists in the communication area of the read/write head.		
	49	Asynchronous system error at copy destination	No data carrier with the assigned ID Code exists in the communication area of the read/write head.		
	4A	Last received data timeout error at copy destination			
	4B	Byte counter error at copy destination	Error of byte counter code.		
	4C	Checksum error at copy destination	Error at generating checksum.		
	4D	Grammatical error at copy destination	Code error on transfer message.		
	4E	Limited time over at copy destination			
	4F	Verify error at copy destination	Data verify error in an operation with verify.		
Program operation error	60	Error upon command execution	Receiving a command while executing another command in the command stay system.	End	1*
	61	Error upon keeping a command	Receiving another command than the reset command while keeping a command in the command stay system.		

Error classi-fication	Error code (EC)	Error name	Contents	Host controller response [a]	Error position (EK) [b]
Program operation error	62	Blocking due to error at command execution	Receiving another command than the reset command after an error between read/write head an the data carrier (error releasable only by the reset command).	End	1*
	63	Blocking the command execution at trigger input OFF	Receiving "next operation start command" or "re-execution command" when trigger input is OFF.		
	64	No command register error	[Command register system] Not registered operation in the specific area even if receiving "operation instruction command when trigger input is ON".		
	65	No startup command error	Receiving "re-execution command" or "next operation start command" without previous receiving of "operation instruction command" when trigger input is ON [Command register system].		00
	66	Communication startup system setting error	Send "operation instruction command when trigger input is ON", "next operation start command" or "re-execution command" in another than the command register system. Receiving a read/write head scan command without adjusted read/write head scan system.		
	67	Register not available	Read/write head of the specific area is on the copy source side of the copying operation at "operation instruction command when trigger input is ON".		
Program operation error	68	Halt command receive error	Received "halt command" at the following conditions: · Occasional execution system · Command stay system · No received "operation instruction command when trigger input is ON" in the command register system. (address 9010_h Do not scan in the read/write head scan system.)	End	00
	69	Error at receiving the result request	Receiving another command than "result request" while waiting for result request in the response request system. · Receiving the result request although not expected.		
	70	Time out between two codes	Time out error at transfer of two codes between host controller and MVI-D2-2HRX.		
	72	Time out between station number "0" and station number "N"	Time out error between "0" and station number "N" in the read/write head scan system.		
	73	Checksum error between station number "0" and station "N"	Checksum error between station number "0" and station number "N" in the read/write head scan system.		
	74	CR error between station number "0" and station number "N"	Incorrect "CR" between station number "0" and station number "N" in the read/write head scan system.		

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10.3 Error Information

Error information can have up to 6 bytes added (12 hexadecimal digits).

Table of Error Information

Error Code (hex.)	Error name	Error information Contents	Number of bytes	Response contents (12 digits)	Notes
18	Protect error	Address of the specified area is set as protect information of the memory area (system area).	2	Address of the specified area ** * * * * * **	
30	RAM error (data carrier)	One error — Error occurrence address	2	Error address	
		Number of errors (Code = 01 one error)	1	Other errors	
		Multiple errors — First error occurrence address	2	Error address — Num-ber of errors — Low voltage 3A — Use ratio 3B *	⇐ set error code
		Number of errors (Code = 02 to FF: error amount)	1		
		Other errors of "self-diagnostic of data carrier" (Battery voltage low alarm: 3A_h, Battery use ratio alarm: 3B_h)	2[a]		
31	ROM error (data carrier)	Other errors of "self-diagnostic of data carrier", (RAM error: 30_h, battery voltage low alarm: 3A_h, battery use ratio alarm: 3B_h)	3[a]	* * * * * * — Other errors — Low voltage 3A — Use ratio 3B — RAM 30	⇐ set error code
34	Block check error	One error — Error block address	2	Error address	
		Number of errors (Code = 01 one error)	1	Num-ber of errors	
		Multiple errors — First error block address	2		
		Number of errors (Code = 02 to FF: error amount)	1		
3B	Battery user ratio alarm (data carrier)	Battery user ratio, battery voltage low alarm (3A_h)	2	Battery use ratio — Low voltage 3A *	"Low voltage" is added when another error occurs.
36, 37	ID verify error	ID code from data carrier	4	ID code * * * — * * * * * *	
47, 4F	Verify error	Verify error address	2	Verify error address of operation completion address	

Error		Error information			Notes
Code (hex.)	Error name	Contents	Number of bytes	Response contents (12 digits)	
40 ... 4F	General communication error	Reading or writing completed final address Communication operation Reading: 10$_h$, Reading with verify: 11$_h$, Reading from data carrier to MVI-D2-2HRX: 13$_h$, Reading with verify from data carrier to MVI-D2-2HRX: 14$_h$ Writing: 20$_h$, Writing with verify: 21$_h$, Writing from MVI-D2-2HRX to data carrier: 23$_h$, Writing with verify from MVI-D2-2HRX to data carrier: 24$_h$ Clear: 30$_h$	2	Operation completion address	

a.   The self-diagnostic checks in order of "ROM check" ⇒ "RAM ceck" ⇒ "Battery life".
When the first error is RAM error, ROM error does not occur.
When the first error is battery voltage low alarm or battery use ratio alarm, ROM error and RAM error do not occur.

10.4 Battery Voltage Low Alarm

When battery voltage of MVI-D2-2HRX or communicated data carrier drops even at normal end, MVI-D2-2HRX or data carrier sends this alarm to the host controller. In this case alarm (W + error position) is added in front of the checksum.

:	:	S T A	A N T	#	Result	W	Position	SC(H)	SC(L)	C R

Alarm

Code	Error occured position
0	Data carrier which faces read/write head number 0
1	Data carrier which faces read/write head number 1
2	Data carrier which faces both read/write head number 0 and read/write head number 1 [a]
3	MVI-D2-2HRX
4	Data carrier which faces MVI-D2-2HRX and read/write head number 0
5	Data carrier which faces MVI-D2-2HRX and read/write head number 1
6	Data carrier which faces MVI-D2-2HRX and read/write head number 0 and 1 [a]

a. Communication operation: Copy between two read/write heads (with verify).

11 Technical Data

Ambient Temperature

Operate the read/write head and the data carrier within the temperature range indicated in the following table.

Item	Model	Ambient temperature
Read/write head	MVH500-F15/MVH2000-F15	-20 °C ... +70 °C
Data carrier	MVC-60-64K/MVC-60-256K/MVC-60B-64K	-20 °C ... +70 °C

Housing

The read/write head and the data carrier each have a housing, that corresponds to the IEC standard (International Electrotechnical Commission Standard), in order to prevent water, oil or solvents from penetrating. Mount the read/write head and the data carrier according to the following table.

Item	IEC standard	Contents
Read/write head	IP65 (dust tight, hoseproof)	Under the following conditions, a direct water jet has no influence for three minutes: Jet position: approx. 3 m off the read/write head. Water pressure: approx. 0.3 kg/m2. Water volume: approx. 12.5 l/min. Jet nozzle: inside diameter approx. 6.3 mm. (Hoseproofness does not include waterproofness)
Data carrier MVC-60-64K/ MVC-60-256K		Under the following conditions, no water penetrates the data carrier, which is in water, for 30 minutes: The water surface and the bottom side is more than 1000 mm below the water surface.

When the data carrier is used in warm water at temperatures of more than 60 °C, the outer surface of the data carrier is hydrolysed and looses its stability.

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Resistance to Chemicals and Solvents

The external parts of the read/write head and the data carrier are made of a material, which is stable and resistant to chemicals and solvents often used in production lines, in order to protect it from mechanical damage such as impacts through tools.

Item	External material	Influence of chemicals and solvents		
		Type	**Typical example**	**Influence**
Read/write head Data carrier	Glass fibre reinforced PTB	Fat	Plex	no Extreme resistance to organic solvents and oil.
		Oil and petrol	Launa 40	
		Coolant	Unisoluble	
		Corrosion preventive	Daphne all coat L2	
		Adhesive	Araldite	
		Colour	#725 Thinner for lacquers	
		Solvents	Trichloroethane	
		Alcohol	Methanol	
		Food	Syrup	
		Solvents	Magiclean	
		Acid	Sulphuric acid	yes The housing can be damaged due to longer contact with powerful acids, alkaline solutions or phenol.
		Caustic solution	Caustic soda	

Vibration and Shock Protection

Read/write head and data carrier are protected against vibration and shock per IEC68-2-6 and IEC68-2-27 when mounted to a vessel or to a pallet.

Vibration Resistance (per IEC68-2-6)

Test content	Condition	
	Read/write head	**Data carrier**
Amplitude	0.7 mm	2 mm
Frequency	10 Hz ... 55 Hz	
Scan rate	One octave/min.	
Scan cycle	Two hours per axis	
Direction	Towards X,Y and Z axis	

Shock Resistance (per IEC68-2-27)

Test content	Condition	
	Read/write head	**Data carrier**
Peak value acceleration	50G	100G
Test time	11 ms	
Test direction	Each X, Y, and Z axial direction	
Number of shocks	Three (18 altogether)	

Cable Flexibility

A very flexible robot cable is used for the read/write head. The cable has a lifetime of 500,000 and 2,500,000 bends or twists on the following conditions:

Bending

Test conditions		Number of bends
Load: 1 kg	Current: 50 mA	
Bending radius: 20 mm	Bending angle: 90°	500,000
Bending velocity: 50/min		

Twisting

Test conditions		Number of twists
Length of test: 1 m	Current: 50 mA	
Tension: 0 g	Twisting angle: 90° for both directions	2,500,000
Twisting velocity: 50/min.		

When the read/write head is to be mounted movable, make sure that the read/write head cable can be freely twisted and bended. When an extension cable is used it should be fixed, since it is sensitive to bending and twisting.

MVI-D2-2HRX

Read/write head

Ferrite absorbers are to be placed upon the cable at a distance of 3 cm from the cable exits.

Extension cable
(Sensitive to twisting strain bending load)

Read/write head cable
(Insensitive to twisting strain and bending load)
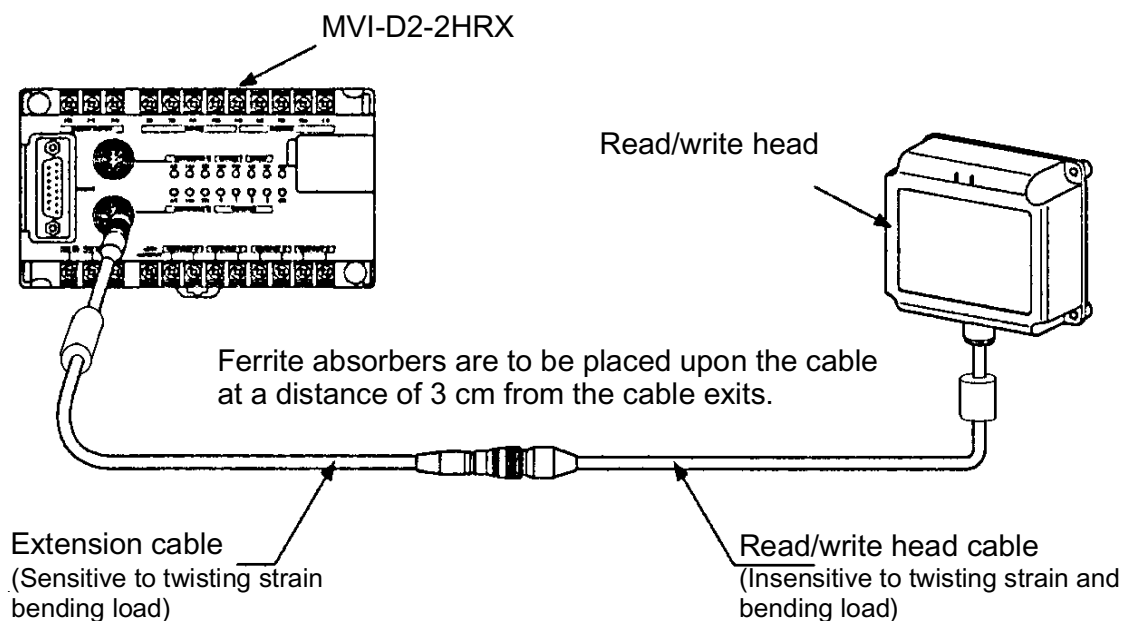
11.1 Lifetime of the Data Carrier's Battery

The data carrier has a built-in lithium battery. The battery has the following current consumption:

Transmission condition between read/write head and data carrier	Current consumption		Function
	Designa-tion	Current value	
No transmission	Standby current	For MVC-60-64K: approx. 20 mA or less	Receiving data in the data carrier; detecting communication signals from read/write heads
Transmission	Active current	For MVC-60-64K: Approx. 12 mA or less (when the LED of the data carrier is not illuminated.) approx. 15 mA or less (when the LED of the data carrier is illuminated.)	Execution of write or read operations by means of read/write heads

Calculate and check the battery life with the current values indicated above.

Calculation of the Battery Life

The lifetime of the battery L (year) can be calulated by means of the activation rate A of the data carrier's transmission time.

$$\text{Activation rate A} = \frac{T_C * N}{24*3600*1000} * \frac{D}{365}$$

T_C (ms)	Transfer time between the read/write head and the data carrier (see page 36)
N	Number of transfer times of the data carrier per day
D	Working days per year
3,600	3,600 s/h
24	24 hours/day
1000	Constant

Battery life L (year) A = $\dfrac{1{,}600 * 0.9}{365 * 24 \,[A * \text{active current} + (1 - A) * \text{standby current}]}$

1,600 Battery capacity (mAh)

0.9 Safety deduction (taking into account the data carrier's production and delivery time)

365 365 days/year   24 24 h/day   A Activation period

Active current : approx. 12 mA or less (when the LED is not illuminated)

Standby current: approx. 20 µA or less

Example

With an average number of 32 bytes per transmission during the reading process (transmission code: 020_8), with the data carrier (MVC-60-64K) and the conditions mentioned below, the average lifetime L will be approx. 8.27 years.

$$Tc = 11.3 + 0.143 * 32 + M_1\left(\frac{32}{128}\right) * 0.5 + M_2\left(\frac{32}{256}\right) * 5.59 = \textbf{15.9 (ms)}$$

Activation rate A = $\dfrac{15.9 * 2000}{24*3600*1000} * \dfrac{300}{365}$ = **0.0003**

Battery life L (year) A = $\dfrac{1900 * 0.9}{365 * 24\,[0.0003 * 12 + (1 - 0.0003) * 0.02]}$ = **8.27**

N 2000 number/day   D 300 days/year

Active current 12 mA   Standby current 20 µA = 0.020 mA

Checking the Battery Life

Check the service life and the battery voltage of the battery integrated in the data carrier by means of the transmission function between the host controller and the data carrier (checking the battery life of the data carrier and self-diagnosis of the data carrier).

- If an error is found during the test, the data carrier sends an error message to the host controller (service life alarm or low battery voltage alarm, see page 185).

Error code	Error designation	Explanation
3A	Low battery voltage alarm	Voltage level of battery is too low
3B	Battery service life alarm	Battery service life exceeds 100 %

In case the battery functions properly, the data carrier sends an acknowledgement containing the battery utilisation rate. In case the battery voltage is too low, the corresponding error message is added to the acknowledgement. This is also done, in case other communication operations are conducted at the same time (see page 185).

Be sure to substitute the data carrier immediately, in case one of these errors occurs.

- Battery utilisation rate (%)

Battery utilisation rate =

$$\frac{\text{Standby time} * 0.02 + \text{active operation time}_1 + 12 + \text{active operation time}_2 * 15}{1900 * 0.9} * 100 \; [\%]$$

Standby time	Current year and month - production year and month - active operation time 1 -
0.02	Standby current (20 mA = 0.020 mA)
Active operation time$_1$	While the data carrier communicates with the read/write head, the LED on the data carrier does not light. (Stores data in the memory addresses 804A to 804D$_h$ of the data carrier).
12	Current = 12 mA
Active operation time$_2$	While the data carrier communicates with the read/write head, the LED on the data carrier lights. (Stores data in the memory addresses 804A to 8051D$_h$ of the data carrier).
15	Current = 15 mA (during communication with the read/write head and illuminated LED on the data carrier).
1,900	Battery capacity (1,900 mA • h)
0.9	Safety deduction (In order to take into account the time interval between production and sale of the data carrier).

12 Appendix

12.1 ASCII (JIS) Code Table

12.1.1 Binary/Hexadecimal Table

- How to use an ASCII code table

Capital letter "A" is located on "4" of the higher-order bit and on "1" of the lower-order bit. Thus, the ASCII code of "A" is → "41_h".

			Lower-order bit															
	bin		**0000**	**0001**	**0010**	**0011**	**0100**	**0101**	**0110**	**0111**	**1000**	**1001**	**1010**	**1011**	**1100**	**1101**	**1110**	**1111**
	bin	**hex**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**A**	**B**	**C**	**D**	**E**	**F**
Higher-order bit	**0000**	**0**	NUL	SOH	STX	ETX	EOT	ENQ	ACK	BEL	BS	HT	LF	VT	FF	CR	SO	SI
	0001	**1**	DLE	DC1	DC2	DC3	DC4	NAK	SYN	ETB	CAN	EM	SUB	ESC	FS	GS	RS	US
	0010	**2**	SP	!	"	#	$	%	&	'	(	)	*	+	,	-	.	/
	0011	**3**	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
	0100	**4**	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
	0101	**5**	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_
	0110	**6**	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
	0111	**7**	p	q	r	s	t	u	v	w	x	y	z	{	|	}	~	DEL

12.1.2 Octal Table

How to use an ASCII code table

Capital letter "A" is located on "10" of the upper two digits and on "1" of the lower digit. Thus, the ASCII code of "A" is → "101_8".

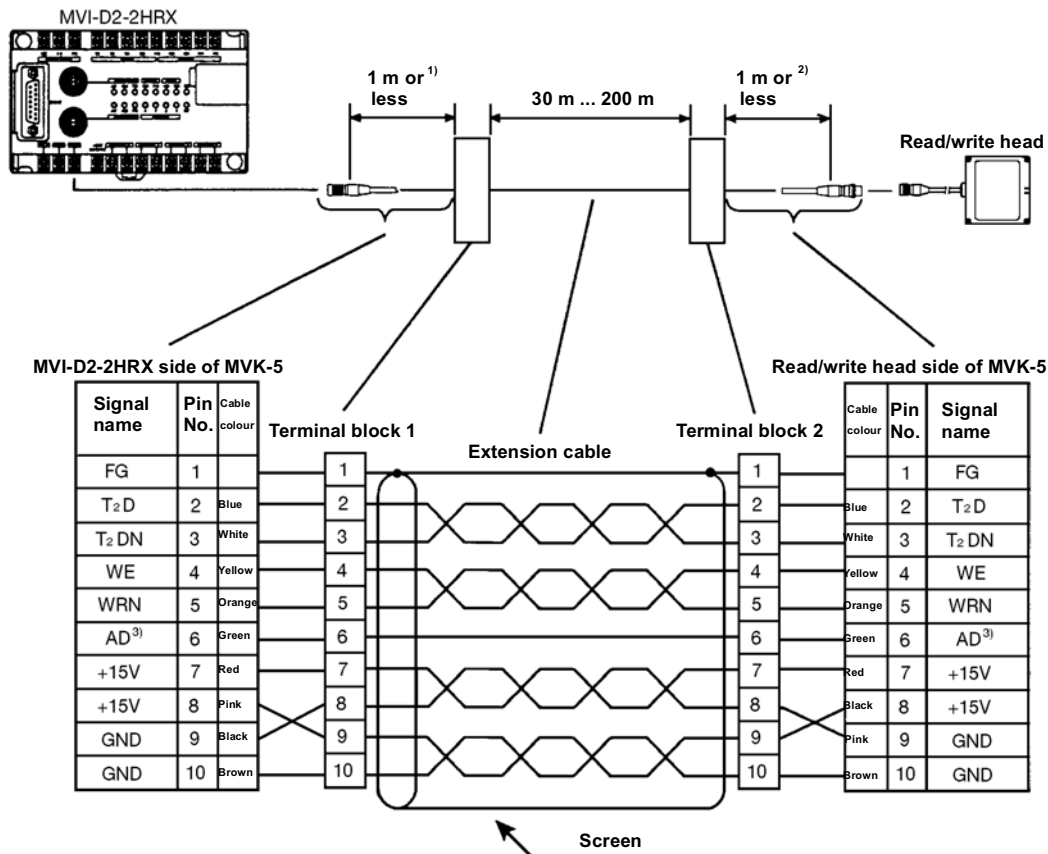|					Lower digit					
	octal	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Upper two digits	**00**	NUL	SOH	STX	ETX	EOT	ENQ	ACK	BEL
	01	BS	HT	LF	VT	FF	CR	SO	SI
	02	DLE	DC1	DC2	DC3	DC4	NAK	SYN	ETB
	03	CAN	EM	SUB	ESC	FS	GS	RS	US
	04	SP	!	"	#	$	%	&	'
	05	(	)	*	+	,	-	.	/
	06	0	1	2	3	4	5	6	7
	07	8	9	:	;	<	=	>	?
	10	@	A	B	C	D	E	F	G
	11	H	I	J	K	L	M	N	O
	12	P	Q	R	S	T	U	V	W
	13	X	Y	Z	[	\	]	^	_
	14	`	a	b	c	d	e	f	g
	15	h	i	j	k	l	m	n	o
	16	p	q	r	s	t	u	v	w
	17	x	y	z	{	|	}	~	DEL

12.1.3 Extension of the Read/Write Head Cable

The following cables are delivered standard as connection cables between the MVI-D2-2HRX and the read/write head: MVK-5 (5 m), MVK-10 (10 m), MVK-20 (20 m) and MVK-30 (30 m). In case a longer cable than the MVK-30 (30 m) is required, the cable length can be extended to 1,200 m.

Extension from 30 m to 200 m

Use of cables with a core cross-section of 0.5 to 1.25 mm^2.

MVI-D2-2HRX

1 m or [1] less | 30 m ... 200 m | 1 m or [2] less | Read/write head

MVI-D2-2HRX side of MVK-5

Read/write head side of MVK-5

Terminal block 1 | Extension cable | Terminal block 2

Signal name	Pin No.	Cable colour							Cable colour	Pin No.	Signal name
FG	1		1			1				1	FG
T_2D	2	Blue	2			2		Blue	2	T_2D
T_2DN	3	White	3			3		White	3	T_2DN
WE	4	Yellow	4			4		Yellow	4	WE
WRN	5	Orange	5			5		Orange	5	WRN
AD[3]	6	Green	6			6		Green	6	AD[3]
+15V	7	Red	7			7		Red	7	+15V
+15V	8	Pink	8			8		Black	8	+15V
GND	9	Black	9			9		Pink	9	GND
GND	10	Brown	10			10		Brown	10	GND

Screen

1) Crop the MVK-5 cable to a length below 1 m on the MVI-D2-2HRX connection side.
2) Crop the MVK-5 cable to a length below 1 m on the read/write head connection side.
3) (Two positions) Wire the AD signal (antenna power monitor) and a GND line as a pair.
4) Extension cable

a. Recommended Cables

Measuring instrument cables having the following features are best suited as extension cables:
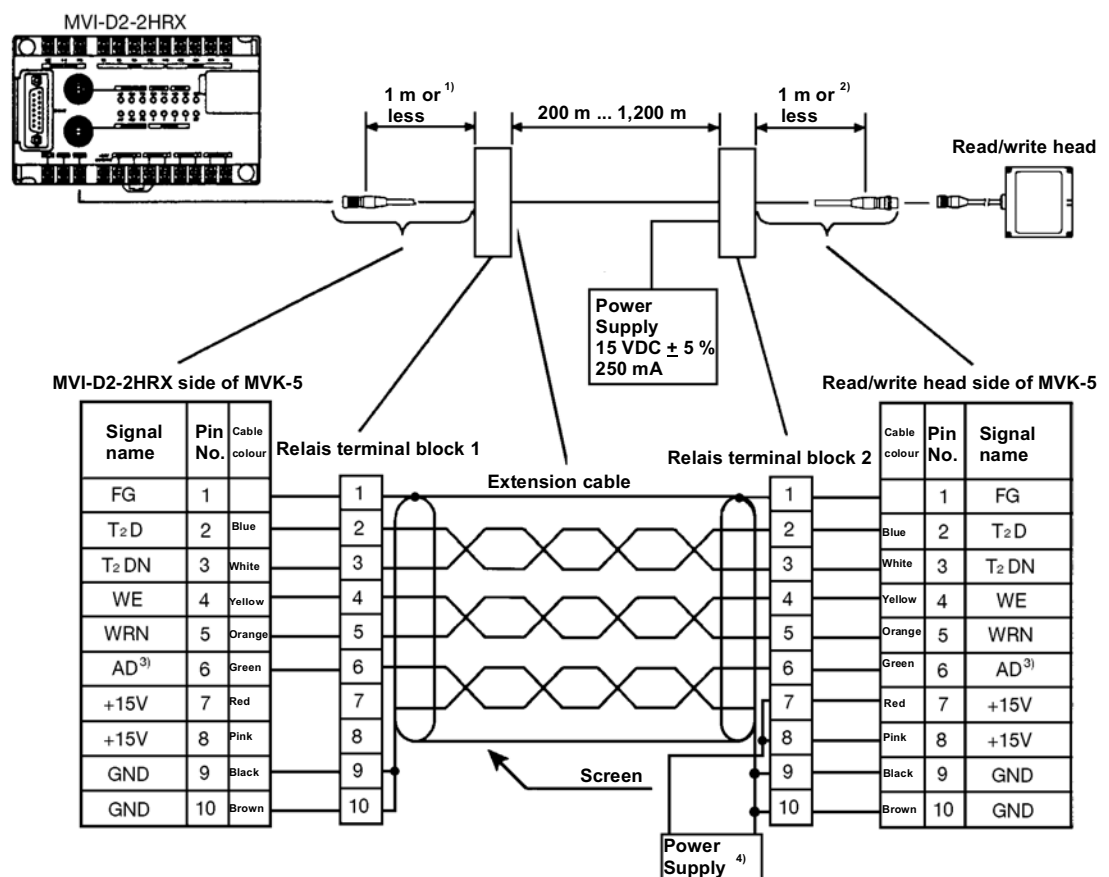
• Insensitive to induction voltages

• Lightweight

• Low external dimension

b. Maximum Cable Length

The supply voltage from the MVI-D2-2HRX to the read/write head drops proportional to the cable length. Determine the conductivity and the extension cable length by means of the calculation example given on the next page, in order to ensure that the voltage drop is less than 1 V.

c. Extension from 200 m to 1,200 m

Use cables with a core cross section of about 0.5 mm^2. In this case, the read/write head should not receive any voltage from the MVI-D2-2HRX. In order to provide the read/write head with voltage, a 15 VDC power supply should be installed alongside the read/write head. In any case, it is necessary to connect 24 VDC to the external power supply connection of the MVI-D2-2HRX. The cable between the read/write head and the MVI-D2-2HRX is only used for data transmission, not for power supply.

MVI-D2-2HRX side of MVK-5

Signal name	Pin No.	Cable colour
FG	1	
T$_2$D	2	Blue
T$_2$DN	3	White
WE	4	Yellow
WRN	5	Orange
AD[3]	6	Green
+15V	7	Red
+15V	8	Pink
GND	9	Black
GND	10	Brown

Read/write head side of MVK-5

Cable colour	Pin No.	Signal name
	1	FG
Blue	2	T$_2$D
White	3	T$_2$DN
Yellow	4	WE
Orange	5	WRN
Green	6	AD[3]
Red	7	+15V
Pink	8	+15V
Black	9	GND
Brown	10	GND

1) Crop the MVK-5 cable to a length below 1 m on the MVI-D2-2HRX connection side.
2) Crop the MVK-5 cable to a length below 1 m on the read/write head connection side.
3) Recommended cable: Lapp cable UNITRONIC®-LiZCY(TP) or equivalent.
4) Recommended power supply: Lütze NG3-0772 Stab.

Calculation Examples

Calculation example for a maximum length of the extension cable (previous page). For a two wire cable, applying the following formula:

$R_D = R_r *(Lm/1,000) * 2/2$

Maximum cable length **Lm [m] = (R_D ´ 1,000)/R_r**

R_D [Ω]: Permissible lead resistance of the extension cable (there and back)

$R_D = E_D / I_S = 1 / 0.25 = 4$ (Ω)

E_D [V]:	Permissible voltage drop between the MVI-D2-2HRX and the read/write head (maximum 1V)
I_S [A]:	Current consumption of the read/write head (0.25 A)

R_R [Ω]: Lead resistance per 1 km at operating temperature

$R_R : R_{20} \{1 + \alpha_{20} (T-20)\}$

R_{20} [α/km]:	Lead resistance at 20 °C
α_{20}:	Temperature coefficient (0.00393)
T [°C]:	Operating temperature

Lm [m] = 4000/Rr
The following table shows calculation examples for T = 70 °C

Conductive area [mm²]	0.5	0.75	0.9	1.25
R_{20}: Lead resistance at 20 °C [Ω/km]	34.0	25.5	21.7	17.2
R_{70} : Lead resistance at 70 °C [Ω/km]	40.7	30.5	26.0	20.6
Maximum cable length [m]	98.0	131.0	154.0	194.0
External dimension (including the covering [mm])	13.0	13.5	14.0	15.0

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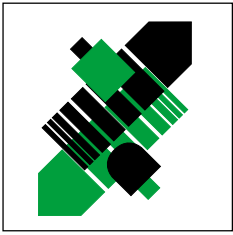
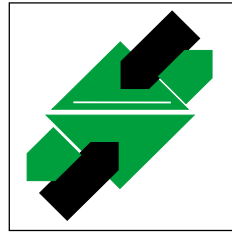## Factory Automation Division

Product Range

- ■ Digital and analogue sensors
- ■ in different technologies
  - ■ Inductive and capacitive sensors
  - ■ Magnetic sensors
  - ■ Ultrasonic sensors
  - ■ Photoelectric sensors
- ■ Incremental and absolute rotary encoders
- ■ Counters and control equipment
- ■ Identification Systems
- ■ AS-Interface

Areas of Application

- ■ Machine engineering
- ■ Conveyor or transport
- ■ Packaging and bottling
- ■ Automotive industry

Process Automation Division

Product Range

- ■ Signal conditioners
- ■ Intrinsically safe interface modules
- ■ Remote Process Interface (RPI)
- ■ Intrinsically safe field bus solutions
- ■ Level control sensors
- ■ Process measuring and control systems engineering at the interface level
- ■ Intrinsic safety training

Areas of Application

- ■ Chemical industry
- ■ Industrial and community sewage
- ■ Oil, gas and petrochemical industry
- ■ PLC and process control systems
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