Agencia de Obra Pública de la Junta de Andalucía
CONSEJERÍA DE FOMENTO, INFRAESTRUCTURAS
Y ORDENACIÓN DEL TERRITORIO

# CONTRATO DE SERVICIOS PARA LA PUESTA EN MARCHA DE LA RED RADIO GSM-R EL TREN-TRANVÍA DE LA BAHÍA DE CÁDIZ

EXPEDIENTE: T-TC6112/OEJ0

## PLIEGO DE PRESCRIPCIONES TÉCNICAS PARTICULARES

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## 1. OBJETO DEL PLIEGO DE PRESCRIPCIONES TECNICAS

El objeto del presente Pliego de Prescripciones Técnicas Particulares es describir y fijar las condiciones técnicas que regirán la contratación de las actuaciones de título y clave:

**CONTRATO DE SERVICIOS PARA LA PUESTA EN MARCHA DE LA RED RADIO GSM-R EL TREN-TRANVÍA DE LA BAHÍA DE CÁDIZ (T-TC6112/OEJ0)**

El objeto del concurso es la actualización tecnológica mínima y puesta en marcha de los equipamientos e instalaciones que forman parte de la red radio GSM-R del Tren-Tranvía de la Bahía de Cádiz, de forma que que permita su funcionamiento integrado con las red de telecomunicaciones GSM-R de ADIF y provea de comunicaciones de voz y datos entre el personal y sistemas en tierra con las unidades de material rodante.

Así se tendrá

- Actualización y Puesta en Marcha del equipamiento SDH (*Synchronous Digital Hierarchy*) de la red GSM-R del TTBC y su conexión con los equipos SDH de la red de comunicaciones de ADIF en San Fernando
- Actualización y puesta en marcha de los sistemas radiantes de la red radio GSM-R del TTBC.
- Actualización de los equipos embarcados de voz y datos de las unidades de material rodante del TTBC.
- Suministro e instalación de equipo de gestión de comunicaciones (Dispatcher) en el Puesto de Control Central del TTBC, en Chiclana de la Frontera.
- Actualización y puesta en marcha de los sistemas de alimentación ininterrumpida de la red radio GSM-R del TTBC, incluyendo la instalación de tarjetas de comunicaciones para integrar su gestión en las redes de comunicaciones de ADIF.
- Ingeniería y Oficina Técnica, para la gestión y coordinación técnica así como la elaboración de la documentación técnica necesaria para la puesta en servicio, operación y mantenimiento.

## 2. DEFINICIONES

A efectos del este Pliego de Prescripciones Técnicas, se entiende que las expresiones siguientes tendrán el significado que, en cada caso, se expone:

**AOPJA**: Agencia de Obra Pública de la Junta de Andalucía.

**ADIF**: Administrador de Infraestructuras Ferroviarias

**TTBC**: Tren-Tranvía de la Bahía de Cádiz.

**RFIG**: Red Ferroviaria de Interés General

**PPTP**: Pliego de Prescripciones Técnicas Particulares.

**PCAP**: Pliego de Cláusulas Administrativas Particulares.

**PCC**: Puesto de Control Central.

**CPD:** Centro de Procesamiento de Datos

**CTA:** Centro de Telecomunicaciones de Atocha (ADIF)

**FOR**: Repetidor de Fibra Óptica

**MAR**: Mobile Access Router



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## 3. CARACTERISTICAS TÉCNICAS DEL CONTRATO

Para garantizar la explotación de la línea, y con ello el servicio comercial, en condiciones de seguridad y calidad de servicio se hace necesaria la actualización y puesta en marcha del actual equipamiento e instalaciones que comprenden la red radio GSM-R del TTBC ya que, debido a la excesiva duración del contrato, T-TC6110/OEJ0, que incluía su suministro y su resolución antes de la conclusión de la totalidad de los trabajos, gran parte de los equipamientos están en obsolescencia, o próximos a ella, siendo necesarias una serie de actuaciones para su puesta en marcha y correcto funcionamiento.

A tal fin, el alcance del contrato comprenderá los siguientes conceptos:

- Equipamiento SDH y conexión con red SDH de ADIF
    - Revisión y actualización de la red SDH del TTBC
    - Conexionado con el equipamiento GSM-R del TTBC
    - Conexión con la red SDH de ADIF
- Equipamiento red radio GSM-R
    - Revisión del sistema radiante en BTS y repetidores FOR
    - Actualización y puesta a punto
    - Conexión con red SDH y Core de ADIF
- Equipos embarcados
    - Para los equipos de voz: actualización y puesta a punto
    - Para los equipos de Datos: sustitución de equipos en obsolescencia, actualización del software de comunicaciones, pruebas y puesta en servicio
- Dispatcher del PCC
    - Suministro, instalación y puesta en marcha del equipo de gestión de llamadas del PCC de Chiclana
- Sistemas de Alimentación Ininterrumpida
    - Revisión y actualización
    - Instalación de tarjetas de comunicaciones e integración de estas en la red de comunicaciones
- Ingeniería y Oficina Técnica
    - Redacción de Informe de Estado inicial
    - Coordinación Técnica del proyecto y actuaciones
    - Apoyo de ingeniería
    - Documentación As Built y Manuales

Como gran parte de los trabajos recogidos en este contrato se van a realizar sobre una línea que se encuentran en servicio en fase de pre-explotación (pruebas, formación, marchas en blanco, etc.), se considera imprescindible que se reduzcan las afecciones a las operaciones debiendo realizarse una coordinación detallada de las actuaciones con los responsables de la operación y mantenimiento del TTBC con objeto de minimizar la afección al servicio. **El contratista deberá contemplar en su valoración económica y de plazo las actuaciones a ejecutar a la hora de evaluar su oferta de obra.**



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A continuación se describen las características principales de cada una de las actuaciones que comprende este contrato.

### 3.1. Equipamiento SDH y Conexión con Red SDH de ADIF

Esta actuación comprende la revisión, actualización y finalización de la instalación, incluyendo su puesta en marcha. Para ello queda incluida la configuración y el conexionado al CTA una vez que el camino esté habilitado por ADIF.

La red de transmisión instalada, con equipos SDH Hit 7025, se interconectará con equipos existentes o a suministrar por ADIF, en los centros de San Fernando Bahía Sur y San Fernando Centro.

ADIF creará el camino al CTA, donde se interconectará con los gestores y equipos controladores de radio.

Dentro del alcance del contrato se incluirá:

- Suministro e Instalación de bandejas, en cada emplazamiento, para la organización de las fibras ópticas y un repartidor intermedio que facilite el conexionado interno con el externo y la realización de pruebas.
- Suministro e Instalación de tarjetas Compact Flash en los equipos. En los casos donde la tarjeta exista y pueda ser reparada, o su contenido restituido, se admite esta reparación.
- Suministro e Instalación de repartidores de Fibra Óptica en los bastidores, completando las tiradas de fibra entre repartidores ópticos e instalación de latiguillos de fibra desde el equipo SDH (HiT7025) a repartidor óptico.
- Suministro e Instalación de dos (2) tarjetas STM-1 necesarias para la interconexión con los equipos de Ericsson de Bahía Sur y San Fernando Centro.
- Etiquetado de cables, anclaje de bastidores y conexión de tierras de los bastidores y nuevo equipamiento.

### 3.2. Equipamiento Red Radio GSM-R

Esta actuación comprende la revisión, actualización y finalización de la instalación, incluyendo su puesta en marcha.

En los Sistemas Radiantes (SSRR, en adelante) de los FOR se procederá a un nuevo tendido e instalación que permita el acceso a los elementos del subsistema que necesiten tareas periódicas de mantenimiento, tales como splitters, descargadores, puestas a tierra, etc. En este nuevo tendido se prestará especial atención a los radios de curvatura en los cables coaxiales.

Así, además de lo expuesto, quedará incluido dentro del alcance de este capítulo las siguientes actuaciones:

- Medición, ajuste y eventual reparación de las medidas de ROE en los sistemas radiantes.
- Ajuste de potencias, cambio de las cargas existentes e instalación de atenuadores.
- Cableado de las alarmas de las Estaciones Base (BTS) e integración de las BTS y FOR en la red SDH.
- Etiquetado de cables, anclaje de bastidores y conexión de tierras de los bastidores y nuevo equipamiento.
- Puesta en marcha del gestor OMC
- Configuración, puesta en marcha en integración con las redes de ADIF



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### 3.3. Equipos Embarcados

Este capítulo abarca tanto los equipos de voz como los de datos embarcados en las unidades de tren-tranvía, así como la interfaz en tierra necesaria para el intercambio de datos y su transmisión a los distintos sistemas de apoyo a la explotación del tren-tranvía a través de su conexión a la red multiservicio del TTBC. De esta forma se tendrá incluido en el alcance del contrato:

- Equipos de Voz:
    - Revisión y actualización de la configuración y software de las cab-radio
    - Revisión y actualización del cableado y configuración de las consolas duales
    - Pruebas y puesta en marcha tras las actualizaciones
- Equipos de Datos:
    - Suministro e instalación de nuevo equipamiento para los MAR, según el modelo expuesto en el Anexo 2.
    - Actualización del software de los MAR y los servidores en tierra.
    - Pruebas y puesta en marcha tras las actualizaciones

El alcance comprenderá hasta un total de nueve (9) equipos embarcados completos, incluyendo la totalidad de sus elementos tales como antenas, servidor GSM-R embarcado e interfaces con conductor y con SAE.

### 3.4. Puesto Despachador de Llamadas (Dispatcher)

Este capítulo comprende el suministro, instalación y puesta en marcha de un Dispatcher GSM-R, de tipo compatible con la red de ADIF, en el PCC de Chiclana.

Dentro del alcance se encuentra el cableado entre el CPD y el puesto de la sala del PCC donde se ubique el Dispatcher, así como todo el pequeño material y mano de obra necesaria.

Las características orientativas de este equipo se pueden encontrar en el Anexo 2.

### 3.5. Sistemas de Alimentación Ininterrumpida

Dentro del alcance de este capítulo se llevarán a cabo las siguientes actuaciones:

- Revisión y actualización de los tres (3) equipos actuales, incluyendo sus baterías
- Instalación y puesta en marcha de tarjetas de comunicaciones SNMP, una por cada equipo, que permitan su supervisión a través de los gestores remotos de ADIF.
- Eventualmente, cableado de las alarmas a los equipos BTS e integración en estos.
- Etiquetado de cables, anclaje de bastidores y conexión de tierras de los bastidores y nuevo equipamiento.
- Pruebas y puesta en marcha

### 3.6. Ingeniería y Oficina Técnica

Dentro del alcance de este capítulo se tendrá:

- Redacción de un Informe de Estado inicial, dentro de los primeros quince (15) días del contrato, donde se defina con exactitud las necesidades en cuanto a materiales, ingeniería, desarrollos y planificación que permitan la ejecución de la obra en el plazo previsto.



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- Coordinación Técnica del proyecto y actuaciones, siendo responsable la persona adjudicataria de la coordinación necesaria para el desarrollo de las actividades del contrato, tanto de sus propios suministradores y subcontratistas como con el resto de empresas que actúan dentro del ámbito del TTBC y, muy especialmente, con los mantenedores de material rodante y de sistemas.
- Apoyo de ingeniería, estando dentro del alcance del contrato tanto el desarrollo de cuantas labores de ingeniería y oficina técnica sean necesarias como el soporte al Responsable del Contrato de AOPJA en materia de telecomunicaciones GSM-R y del ámbito del contrato.
- Documentación As Built y Manuales, comprendiendo las siguientes tareas
    - Elaboración de la documentación As Built de las instalaciones, tanto en tierra como embarcadas, dentro del alcance del contrato
    - Elaboración de los Manuales de Operación y de Mantenimiento de las instalaciones, tanto en tierra como embarcadas, dentro del alcance del contrato.
    - Apoyo al Responsable del Contrato de AOPJA, o quien este designe, en la elaboración del Informe Final de Obra y del Proyecto de Liquidación.

## 4. LUGAR DE LOS TRABAJOS

Dada la complejidad de algunos desarrollos y modificaciones del software de los sistemas, estos podrán ser llevados a cabo en los laboratorios de la persona adjudicataria, así como las pruebas "de factoría" (FAT) previas a su despliegue en los sistemas del tren-tranvía.

La instalación de los desarrollos y modificaciones, junto con el hardware asociado, además de las pruebas de aceptación (SAT) y puesta en marcha se realizarán in situ, ya sea en el propio CPD/PCC del TTBC, en las unidades de material rodante, en las instalaciones a lo largo de la Línea 1 del TTBC o en las salas técnicas y centros de gestión de ADIF.

## 5. PRESCRIPCIONES ADICIONALES QUE EL LICITANTE HABRA DE CUMPLIMENTAR EN SU OFERTA.

De acuerdo con lo especificado en el PCAP se habrán de cumplir las siguientes prescripciones, debiendo incluirse en la solución técnica detallada y considerándose su coste incluido en la estructura de unidades de obra prescrita en el Anexo 1.

### 5.1. Autorizaciones y licencias

El Adjudicatario será responsable de la obtención de todas las autorizaciones, permisos y licencias necesarias para el desarrollo completo del alcance del contrato, conforme a lo previsto en el presente Pliego y en el PCAP, tanto de la propia AOPJA como de cualesquiera otros organismos y administraciones que puedan verse involucradas por el alcance de las actividades del contrato.

En aquellos casos donde la normativa en vigor exija que el trámite sea realizado por AOPJA, o su Dirección de Obra, el contratista estará obligado, sin coste alguno para AOPJA, a prestar el apoyo necesario para la consecución de los trámites necesarios en forma y plazo.



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### 5.2. Cumplimiento de las medidas medioambientales correctoras y preventivas durante la ejecución de las obras

El Adjudicatario desarrollará las medidas correctoras y preventivas respecto a las directrices medioambientales propias de las actividades que serán recogidas en el Plan de Obra a redactar, de tal forma que quede constancia de las actuaciones en ese sentido a realizar durante la ejecución de los trabajos.

### 5.3. Plazo de ejecución de las obras

El plazo máximo del desarrollo del contrato, desde la Orden de Inicio hasta la puesta en marcha de la totalidad de las actuaciones, dentro del ámbito definido en este Pliego y en el PCAP será de DOS (2) MESES.

Teniendo en cuenta los condicionantes descritos, el licitador especificará dentro del Plan de Obra aquellos hitos, tanto propios como externos, que considere críticos para el cumplimiento de su plan de obra.

### 5.4. Puesta en servicio y plan de ensayos

Sin perjuicio de lo especificado en el capítulo de este pliego correspondiente al Control de Calidad, el licitador deberá incluir en sus actividades, un plan de ensayos y puntos de inspección preliminar donde se definan las pruebas genéricas, así como plazo y condiciones necesarias para su ejecución, a realizar sobre los diferentes sistemas para su puesta en servicio.

El adjudicatario, en base al plan de ensayos citado, deberá desarrollar un Plan de Pruebas y Puntos de Inspección detallado, incluyendo descripción de escenarios y hojas de registro y validación, que habrán de ser incluidos en el Plan de Obra.

La verificación de la idoneidad del suministro o instalación se realizará mediante la comprobación de un Programa de Puntos de Inspección (PPI), que ajustará a los siguientes criterios:

- Completitud. Se comprobará que el trabajo entregado cubre las exigencias de este documento y de las mejoras que pudieran ser aportadas en la oferta.
- Trazabilidad. El PPI se formalizará de manera que sea fácilmente trazable desde los requisitos básicos a extraer de este documento.
- Calidad del sistema. Pruebas de funcionamiento, pruebas de estrés, comunicación de alarmas y alertas, funcionamiento en modo degradado, funcionamiento en modo local y centralizado

### 5.5. Mantenimiento, FDMS y Plazo de Garantía

En las propuestas técnicas se deberán incluir, de manera explícita, los valores FDMS propuestos tanto para los sistemas principales que se modifican como para la unidad en su conjunto así como una actualización del Plan de Mantenimiento en el cual se garantice tanto el nivel de requisitos FDMS propuesto.

## 6. CONDICIONANTES TECNICOS

Todos los materiales deben de ser recepcionados por personal cualificado antes de su puesta en obra. La Dirección de Obra debe dar su visto bueno antes de ser instalado, previa información al Gerente de Obra de AOPJA.

Cualquier trabajo que suponga alguna incidencia sobre la circulación en la línea del tren-tranvía, ya sea en pruebas o en circulación comercial, deberá ser informado a la Dirección de Obra y al Operador de la Línea a fin de analizar y programar las actuaciones de acuerdo con la situación de pruebas o explotación existente. Se realizará, con la antelación suficiente, una propuesta en la que se adjuntarán los medios y



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las medidas a adoptar. La Dirección de Obra a su vez mantendrá informado al Gerente de Obra de todas y cada una de las incidencias producidas durante el desarrollo del contrato.

En el caso de interferencia con el tráfico viario, tanto peatonal como de vehículos, o ferroviario durante períodos prolongados, se establecerá una situación provisional a estudiar y determinar con objeto de disminuir los efectos negativos sobre el tráfico o los servicios afectados.

Cualquier incidencia a en los servicios existentes producida por la actuaciones dentro del alcance del contrato deberá ser comunicada a la Dirección de Obra y prever las medidas necesarias para su reparación bajo su supervisión. En caso de que la incidencia sea reparada por el mantenedor de los servicios y esta sea imputable al contrato, el Adjudicatario deberá abonar los costes de reclamación, así como las reclamaciones derivadas de los compromisos contractuales que el explotador del servicio tenga contraídos con sus clientes.

## 7. CONTROL DE CALIDAD

En el punto presente se definen los distintos conceptos relativos a lo que se entiende AOPJA que debe constituir el Control de Calidad de las obras, que se deben incluir en los correspondientes procedimientos operativos de los distintos sistemas de calidad de los intervinientes en las mismas.

Se entiende por Control de Calidad al conjunto de los tres conceptos siguientes:

A. Control de Calidad de Materiales y Equipos (CCM)

B. Control de Calidad de Ejecución (CCE)

C. Control de Calidad de Parámetros y Software (CCS)

Contemplando quién es el sujeto que realiza el Control de Calidad tenemos lo siguiente:

D. Control de Calidad de Producción (CCP)

E. Control de Calidad de Recepción (CCR)

Trataremos aquí básicamente de la clarificación en relación con estos dos últimos conceptos, puesto que del detalle de los tres primeros se ocupan las Normativas, Instrucciones, Órdenes Circulares, Recomendaciones, etc.

### 7.1. El Control de Calidad de Producción

La responsabilidad de la calidad, que bajo los tres conceptos citados de Materiales y Equipos, Ejecución y Geometría han de poseer los elementos producidos, corresponde al Adjudicatario del contrato, ya ejecute este directamente o por medio de terceros.

Por tanto, el Control de Calidad de Producción, le corresponde al Adjudicatario, que lo desarrollará encuadrado en un Plan de Aseguramiento de la Calidad (PAC) redactado según la Norma UNE-EN ISO 9001.

Se entiende que los factores fundamentales para la producción con calidad, por parte de dicho Adjudicatario reside en la capacidad y calidad de los medios personales, materiales y garantías de calidad que se aporten. Entre ellos:

a) Formación y experiencia de los medios personales de producción tales como Jefe de Proyecto, Encargados, Montadores, etc. El control del contratista en este aspecto debe asegurar que los medios personales de producción tienen la capacidad de producir con calidad.

b) Capacidad y calidad de los medios materiales de producción tales como procedimientos y medios de desarrollo de software, procedimientos y medios para la instalación de equipos y sistemas informáticos, etc.



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c) Personal y medios utilizados por el contratista para el Control de Calidad de los Materiales y Equipos, básicamente en origen (productos prefabricados, manufacturados, etc.), realizado desde el lado del Contratista y por él, ya sea con medios propios o con entes externos.

d) Análogamente, personal y medios utilizados por el Contratista para el Control de Calidad de la Ejecución (CCE), y Control de Calidad de Parámetros y Software (CCS), en la comprobación de la idoneidad de los procedimientos de replanteo e instalación del equipamiento, de los procedimientos de puesta marcha de los sistemas, etc. La disposición del personal y medios de control por parte del Contratista debe asegurar que no existan incidencias de consideración en la recepción de las unidades de obra.

e) Redacción e implantación de un adecuado Plan de Aseguramiento de la Calidad (PAC)

AOPJA, o quien esta designe verificará que, efectivamente, la calidad contratada se produce a través de inspecciones, pruebas, ensayos, etc., en lo que constituye el Control de Calidad de Recepción (CCR). Dentro de este CCR se realizará el Control de Calidad de Materiales (CCM), a través de la aportación por parte del contratista de la documentación acreditativa de la adecuación e idoneidad de los materiales que se suministran, realizándose el Control de Calidad de la Ejecución (CCE) y el Control de Calidad de Parámetros y Software (CCS) a través de las pruebas y ensayos previstos en el Plan de Pruebas y Puntos de Inspección propuesto por el Contratista y aprobado por AOPJA o quien esta designe.

En definitiva, el contratista a través de su Plan de Aseguramiento de la Calidad (PAC) se responsabiliza de su propia gestión de la calidad, con independencia de la verificación (o recepción) por parte de la Dirección de Obra.

El Plan de Aseguramiento de la Calidad del Contratista, será:

1.- Considerado como un Control de Calidad de Producción, necesario para que el propio Contratista pueda disponer por un lado y a su juicio y riesgo, de la suficiente garantía de que serán aceptados, en principio, por la parte contratante, los materiales, unidades de obra, equipos, etc., aportados o ejecutados por él o por terceros, subcontratados por él.

2.- Valorado positivamente en función de los compromisos que contraiga el Contratista en la aportación de medios humanos, medios materiales y del autocontrol que establezca respecto a su capacidad de producir con calidad.

3.- Excepto que el PPTP del presente Concurso pueda establecer otra cosa, las posibles pruebas o ensayos que incluya el Plan de Aseguramiento de la Calidad del Contratista, serán para su propia gestión de la calidad.

Las comprobaciones, ensayos, etc. para la aceptación inicial, rechazo o aceptación inicial con penalización de los materiales, unidades de obra, equipos, etc. por parte de la parte contratante, serán realizadas por la Dirección de Obra, para lo cual ésta contará con los medios personales y materiales oportunos, independientes de los del Contratista, aunque cuente con el apoyo de los medios de este para la ejecución de los ensayos.

El Contratista enviará a la Dirección de Obra durante la ejecución de la obra y periodo de garantía, puntualmente y a diario, la documentación generada por el PAC.

Dado que el PAC del contratista es un control de producción y va dirigido a producir con calidad**, los costes derivados del mismo se considerarán incluidos en los precios unitarios de la oferta del Adjudicatario.**



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### 7.2. El Control de Calidad de Recepción

El Control de Calidad de Recepción le corresponde a la Dirección de Obra. En cuanto al Control de Calidad de Materiales y Equipos (CCM), lo realizará igualmente la Dirección de Obra. Este control se basará en la supervisión de la documentación y certificaciones de los materiales y equipos, pudiendo la Dirección de Obra requerir la ejecución de los ensayos necesarios, por parte de un laboratorio especializado, para asegurar la calidad de estos materiales. Este control adicional, en caso de ser necesario, se hará a cuenta del 1% del presupuesto reservado para la ejecución del Control de Calidad por parte de la Administración.

Se entiende por Control de Calidad de Recepción, los tres conceptos siguientes:

A. Los ensayos de Control de Calidad de Materiales y Equipos (CCM) que servirán de base al Director de Obra para la aceptación inicial, rechazo o aceptación inicial con penalización de los materiales o de las unidades de obra, serán los que realice, si fuera necesario, el laboratorio especializado de Control de Calidad de Materiales (Laboratorio de Control de Calidad de Materiales y Equipos de Recepción) así como los controles que realice el propio equipo de la Dirección de Obra.

B. Los Controles de Calidad de la Ejecución (CCE), (procedimientos de inspección, tolerancias, tarados, de los medios de producción, etc.), que servirán de base al Director de Obra para la aceptación inicial, rechazo o aceptación inicial con penalización de las unidades de obra implicadas, serán los que realice el Control de Calidad de Ejecución, que ejecutará directamente el equipo de Dirección de Obra.

C. El Control de Calidad de Parámetros y Software (CCS) (Requisitos eléctricos y ópticos a cumplir por la red de cableado, requisitos funcionales de partida de los sistemas, desarrollo, instalación, verificación, control de versiones, procedimientos acordes con la normativa de seguridad, etc.) que servirán de base al Director de Obra para la aceptación inicial, rechazo o aceptación inicial con penalización de las unidades de obra implicadas, que realizará directamente el equipo de Dirección de Obra.

En todos los casos el Contratista estará obligado a prestar apoyo a la Dirección de Obra en la ejecución de los controles expuestos. Cuando este apoyo implique la puesta a disposición de la Dirección de Obra de materiales, equipamiento o personal especializado ajeno al propio equipo de trabajo ofertado por el contratista estos costes serán a cuenta del 1% del presupuesto reservado para la ejecución del Control de Calidad por parte de la Administración.

Es de señalar que las citadas aceptaciones iniciales pasarán a definitivas, cuando transcurrido el plazo de ejecución, primero, y de garantía de la obra, después, no se aprecien deficiencias en las mismas. Todo ello sin perjuicio de la responsabilidad decenal que establece la legislación vigente.

Los gastos adicionales de ensayos u otros controles y trabajos, a realizar por la Dirección de Obra o por terceros contratados al efecto por ésta, en razón de previsibles defectos de calidad, detectados ya sea durante el periodo de construcción o de garantía, serán abonados por el Contratista en el caso de confirmación de la existencia de defecto. El Contratista será informado previamente por la Dirección de Obra de las razones por las que tales trabajos son requeridos. Los referidos defectos serán corregidos, a su cargo, por el Contratista, excepto que sea probado que no son de su responsabilidad como adjudicatario y ejecutor de la obra.

El Contratista recibirá puntual información de los resultados de todas las inspecciones, ensayos, controles, etc. que realice el Control de Calidad de Recepción y la Dirección de Obra, ya sea durante la realización de las obras o durante el periodo de garantía y, recíprocamente, la Dirección de Obra recibirá puntualmente información de todos los documentos generados en la aplicación del PAC por el contratista.



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## 8. GESTIÓN MEDIOAMBIENTAL

El Adjudicatario definirá las actuaciones medioambientales a realizar teniéndose en cuenta las siguientes consideraciones:

- La responsabilidad de los residuos recae en la empresa contratista, que será responsable de su gestión y asumirá los gastos que se deriven de ello.
- Será responsabilidad de la empresa contratista el ejecutar las medidas oportunas, hasta la total restitución del terreno, en el caso de que se produzca un accidente y como consecuencia de él se contamine el suelo o se produzcan vertidos accidentales a un cauce público.
- El adjudicatario está obligado a que la maquinaria a utilizar en la realización de los trabajos cumpla con la normativa vigente sobre emisiones, tanto de gases como sonoras.
- El adjudicatario será responsable de la obtención de los correspondientes permisos administrativos necesarios para la correcta ejecución de la obra (consumos de agua, vertidos, gestión de residuos,...), debiendo asumir los costes que de ello derive.
- El adjudicatario designará a la persona, o grupo de personas, responsables en materia medioambiental. Estas personas reportarán a la Dirección de Obra sobre las acciones y tramites en materia medioambiental.
- Con carácter previo al comienzo de las obras el adjudicatario entregará a AOPJA un manual de buenas prácticas ambientales. Este incluirá todas las medidas, acordadas por la Dirección de Obra y el responsable en materia medioambiental del adjudicatario, necesarias para evitar impactos derivados de la ejecución de las obras.

## 9. APROBACIÓN DE SUBCONTRATISTAS Y PROVEEDORES.

Los subcontratistas y proveedores deberán ser autorizados por el Director de Obra, habiendo sido previamente aprobado por el Gerente del contrato.

Los trabajos deberán ser realizados por empresas homologadas en las distintas especialidades que se precise en la obra.

Al menos quince días antes del comienzo de los trabajos por parte de una subcontrata o proveedor, el contratista presentará a la Dirección de Obra una "Solicitud de Aprobación", en el que se incluyan los datos que procedan de los relacionados a continuación:

i. Datos de la empresa:

- Nombre, NIF, dirección y teléfono.
- Actividad que desarrolla
- Clasificación
- Ámbito (Local / Regional / Nacional)
- Volumen de negocio en los últimos 4 años
- Nº total de trabajadores en los últimos 4 años
- Cumplimiento Seguridad Social y Nóminas.
- Relación de trabajos similares ejecutados anteriormente (obra, importes, fechas, razón social del cliente, nombre del director de la obra o del representante del cliente)



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ii. Trabajos a realizar

- Unidades de obra a ejecutar o aprovisionamientos a realizar.
- Periodo de presencia en la obra
- N° trabadores empleados en la obra (Disponibilidad de Medios Humanos)
- Importe del subcontrato o aprovisionamiento (Euros)
- % del subcontrato o aprovisionamiento, respecto al PEM
- Relación de equipos y medios auxiliares en propiedad que esta dispuesto a disponer en obra.

iii. Documentación Técnica y de Calidad.

- Características Técnicas del Producto y Ensayos de Control de Calidad Fábrica.
- Certificados de Sistemas de Calidad de la Empresa.
- Certificados de Calidad del Producto
- Homologación del Proveedor por el Contratista.
- Especificaciones Técnicas de Compra.
- Fichas de Recepción de Materiales en Obra.
- Prevención de Riesgos laborales
- Otros datos de interés relativos a la subcontrata o aprovisionamiento

El Director de Obra, previa aprobación del Gerente del Contrato, dará, en su caso, su aprobación provisional del subcontratista o proveedor, lo que no significa que después durante la ejecución de la obra pueda ser recusado alguno de los citados.

Idéntico trámite deberá realizarse en los supuestos de trabajos subcontratados por empresas a su vez subcontratistas del contratista principal (subcontratación en cascada), debiendo el contratista especificar esta circunstancia a la dirección de obra en dicha solicitud de aprobación.

La documentación de aprobación de subcontratistas y proveedores se archivará en una carpeta específica, que contendrá un dossier para cada subcontrata o suministro aprobado.

## 10. VIGILANCIA DE LAS OBRAS

La responsabilidad de la vigilancia de las obras, de la maquinaria, de los materiales y de las herramientas durante la totalidad de la duración del contrato, incluyendo las posibles prórrogas, irá a cargo del adjudicatario, reparando o reponiendo, en su caso y a su cargo, los que sean necesarios por deterioro, sustracción o destrucción y sin tener derecho por ello a ampliaciones en los plazos de ejecución.

## 11. OFICINA DE OBRA

Será obligación del Contratista disponer de un local de oficinas para el seguimiento de los trabajos del contrato. Esta oficina estará convenientemente equipada y, preferentemente, se ubicará en las inmediaciones de la Línea 1 del TTBC.



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Agencia de Obra Pública de la Junta de Andalucía

CONSEJERÍA DE FOMENTO, INFRAESTRUCTURAS Y ORDENACIÓN DEL TERRITORIO

# CONTRATO DE SERVICIOS PARA LA PUESTA EN MARCHA DE LA RED RADIO GSM-R EL TREN-TRANVÍA DE LA BAHÍA DE CÁDIZ

EXPEDIENTE: T-TC6112/OEJ0

## ANEXO 1. ESTRUCTURA DEL PRESUPUESTO

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2 ESTRUCTURA DEL PRESUPUESTO.....4



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# 1 INTRODUCCIÓN

El objetivo del documento es definir la estructura del presupuesto, y desglose en capítulos, sub-capítulos y unidades de obra, que se usará para el control de avance del contrato y facturación.



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## 2 ESTRUCTURA DEL PRESUPUESTO

| Item | Descripción | Medición | Unidad | Precio unitario | Sub-Total | Total |
|---|---|---|---|---|---|---|
| **1** | **EQUIPAMIENTO SDH** | | | | | **17.159,04** |
| 01.01 | Suministro y montaje de repartidor de fibra óptica equipado con subbastidor con capacidad para 16 fibras ópticas. Totalmente montado y conexionado. Incluye material de conexionado. | 3,00 | Unidad | 620,00 | 1.860,00 | |
| 01.02 | Suministro e Instalación latiguillos y tendidos de cable Fibra óptica multimodo para conexión de equipos dentro de las dependencias, incluye conectores. Totalmente montados. (en metro lineal) | 80,00 | Metro Lineal | 5,00 | 400,00 | |
| 01.03 | Suministro e Instalación de tarjetas STM-1 para conexión con red de ADIF | 2,00 | Unidad | 3.088,77 | 6.177,54 | |
| 01.04 | Suministro e instalación de puesta a tierra de los equipos, completamente montado y conexionado. | 3,00 | Unidad | 232,50 | 697,50 | |
| 01.04 | Conexión a los equipos de ADIF en Bahía Sur y San Fernando Norte | 16,00 | Hora | 59,00 | 944,00 | |
| 01.05 | Revisión final, etiquetados, pruebas y puesta en marcha | 120,00 | Hora | 59,00 | 7.080,00 | |
| **2** | **EQUIPAMIENTO RED RADIO** | | | | | **42.021,50** |
| 02.01 | Suministro e Instalación de nuevo cable coaxial desde FOR hasta emplazamiento de antenas, incluyendo elementos auxiliares como splitters, descargadores, puesta a tierra, etc.<br>Incluye canaleta o tubo de protección, con sus anclajes, fijaciones, sellados y pequeño material para montaje intemperie.<br>Incluye desmontaje del cable anterior, retirada a vertedero y gestión de residuos | 1.200,00 | Metro Lineal | 15,95 | 19.140,00 | |
| 02.02 | Suministro e instalación de puesta a tierra de los equipos, completamente montado y conexionado. | 3,00 | Unidad | 232,50 | 697,50 | |
| 02.03 | Configuración, definición y cableado de alarmas e integración de repetidores FOR | 64,00 | Hora | 59,00 | 3.776,00 | |
| 02.04 | Actualización configuraciones y software para conexión con red GSM-R de ADIF | 96,00 | Hora | 59,00 | 5.664,00 | |
| 02.05 | Instalación y Configuración del Gestor OMC | 56,00 | Hora | 59,00 | 3.304,00 | |



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| Item | Descripción | Medición | Unidad | Precio unitario | Sub-Total | Total |
|---|---|---|---|---|---|---|
| 02.06 | Revisión final, etiquetados, pruebas y puesta en marcha | 160,00 | Hora | 59,00 | 9.440,00 | |
| **3** | **EQUIPOS EMBARCADOS** | | | | | **70.864,00** |
| 03.01 | Actualización del software y revisión de la configuración y cableados de las Cab-Radio | 336,00 | Hora | 59,00 | 19.824,00 | |
| 03.02 | Suministro de nuevo equipamiento de comunicaciones de datos | 9,00 | Unidad | 2.000,00 | 18.000,00 | |
| 03.03 | Instalación, Configuración y Pruebas de los nuevos equipos de comunicaciones | 336,00 | Hora | 59,00 | 19.824,00 | |
| 03.04 | Revisión final, etiquetados, pruebas y puesta en marcha | 224,00 | Hora | 59,00 | 13.216,00 | |
| **4** | **DISPATCHER PCC** | | | | | **37.552,00** |
| 04.01 | Suministro e Instalación de equipo Dispatcher en sala PCC, incluyendo cableados hasta la sala de servidores | 1,00 | Unidad | 30.000,00 | 30.000,00 | |
| 04.02 | Revisión final, etiquetados, pruebas y puesta en marcha | 128,00 | Hora | 59,00 | 7.552,00 | |
| **5** | **RECTIFICADORES (SAI)** | | | | | **15.819,50** |
| 05.01 | Suministro e Instalación de tarjetas Ethernet para la integración de los Rectificadores en los clientes de gestión de mantenimiento | 3,00 | Unidad | 950,00 | 2.850,00 | |
| 05.02 | Integración en los gestores de mantenimiento | 144,00 | Hora | 59,00 | 8.496,00 | |
| 05.03 | Suministro e instalación de puesta a tierra de los equipos, completamente montado y conexionado. | 3,00 | Unidad | 232,50 | 697,50 | |
| 04.02 | Revisión final, etiquetados, pruebas y puesta en marcha | 64,00 | Hora | 59,00 | 3.776,00 | |
| **6** | **INGENIERIA Y OFICINA TÉCNICA** | | | | | **26.668,00** |
| 06.01 | Redacción de Informe de Estado inicial | 96,00 | Hora | 59,00 | 5.664,00 | |
| 06.02 | Coordinación Técnica del proyecto y actuaciones | 204,00 | Hora | 59,00 | 12.036,00 | |
| 06.03 | Apoyo de ingeniería | 80,00 | Hora | 59,00 | 4.720,00 | |
| 06.04 | Documentación As Built y Manuales | 72,00 | Hora | 59,00 | 4.248,00 | |
| **PEM** | **PRESUPUESTO EJECUCIÓN MATERIAL** | | | | | **210.084,04** |
| GG | GASTOS GENERALES | 13% | | | | 27.310,92 |
| BI | BENEFICIO INDUSTRIAL | 6% | | | | 12.605,04 |
| **PEC** | **PRESUPUESTO EJECUCIÓN CONTRATA** | | | | | **250.000,00** |
| IVA | | 21% | | | | 52.500,00 |
| **PBL** | **PUESTO BASE LICITACIÓN** | | | | | **302.500,00** |



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Agencia de Obra Pública de la Junta de Andalucía

CONSEJERÍA DE FOMENTO, INFRAESTRUCTURAS Y ORDENACIÓN DEL TERRITORIO

# CONTRATO DE SERVICIOS PARA LA PUESTA EN MARCHA DE LA RED RADIO GSM-R EL TREN-TRANVÍA DE LA BAHÍA DE CÁDIZ

EXPEDIENTE: T-TC6112/OEJ0

## ANEXO 2

## CARACTERÍSTICAS DE LOS EQUIPOS PRINCIPALES A SUMINISTRAR

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1. **INTRODUCCIÓN**
2. **DISPATCHER GSM-R**
3. **MOBILE ACCESS ROUTER (MAR)**
4. **TARJETA DE COMUNICACIONES PARA MAR**
5. **TARJETA DE COMUNICACIONES PARA SISTEMAS DE ALIMENTACIÓN ININTERRUMPIDA**



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# 1 INTRODUCCIÓN

El objetivo del documento es definir, de manera orientativa, las características técnicas y funcionales de los equipos principales cuyo suministro e instalación se encuentra dentro del alcance del contrato.



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# 2 DISPATCHER GSM-R



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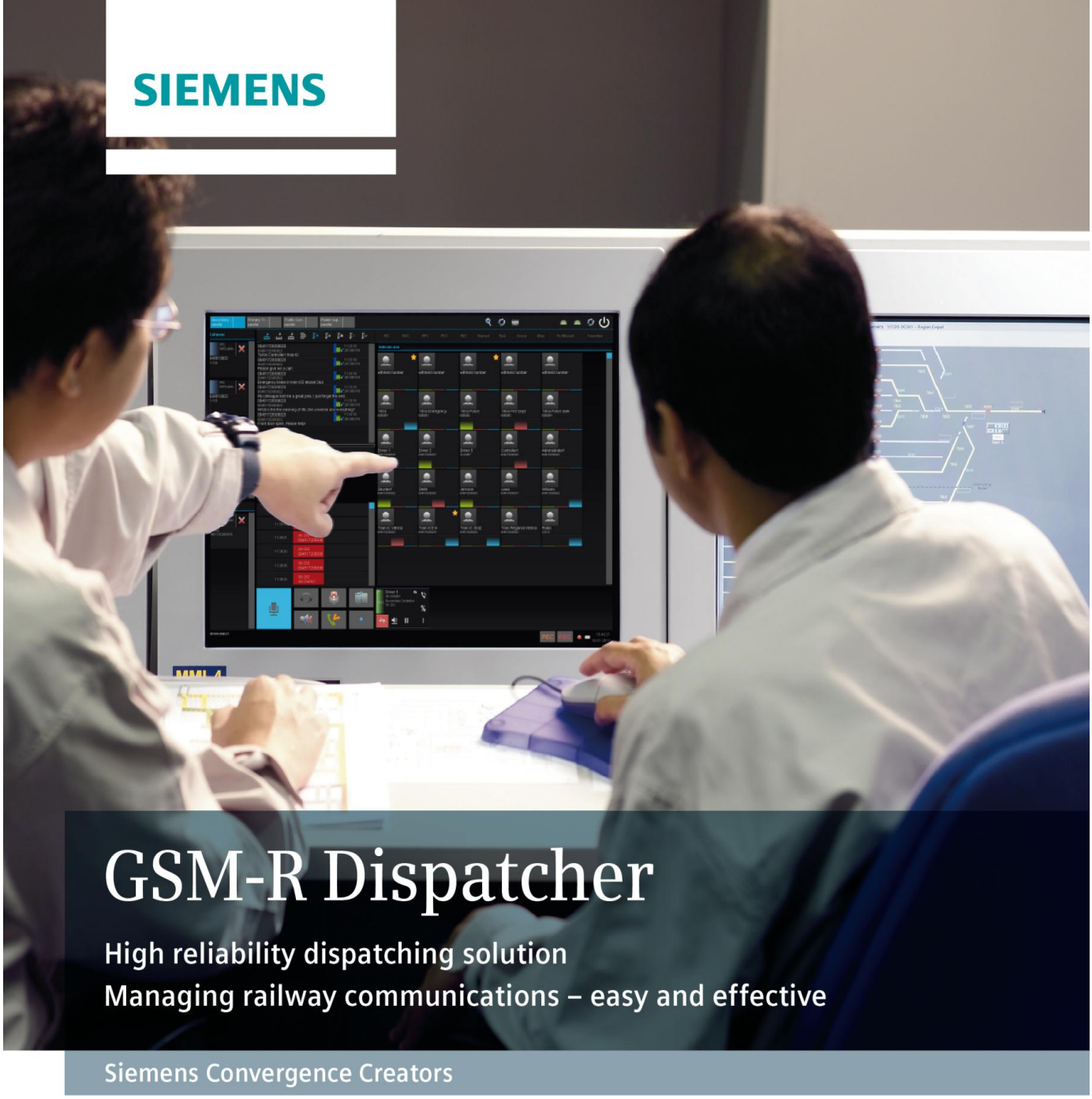

SIEMENS

# GSM-R Dispatcher

High reliability dispatching solution

Managing railway communications – easy and effective

Siemens Convergence Creators

## Product description

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# 1 Introduction

## 1.1 Siemens Convergence Creators

Siemens Convergence Creators is a global partner for communication and media demands within a broad range of market segments.

We provide innovative products, turnkey solutions, and services in the fields of communication networks, service and customer management, railway control and communication, public security, multimedia infotainment, and aerospace technology.

## 1.2 IFDS GSM-R Dispatcher

Modern passengers expect nothing less than perfection from a railway operator. In a business where even a 5-minute delay is a major cause for complaints, railway operators need to make sure that every single staff member knows exactly what to do in order to enable the complex interplay of operations necessary to guarantee efficient and safe operations.

Trains running and railway workers working in the same geographic area have to be coordinated by central dispatcher controllers to avoid accidents, to ensure security and safety and to improve efficiency. For these purposes, clear and efficient voice and text communication is vital. GSM-R fixed line dispatching systems are international standard solutions for providing efficient and effective communication tools between railway controllers, train drivers and other railway workers.

### 1.2.1 Purpose of the Product

As specified in the Function Requirement Specification (FRS) and the System Requirement Specification (SRS) of EIRENE, the fixed line GSM-R dispatcher is a mandatory part of a complete GSM-R communication system enabling safe, effective and efficient railway operations.

The GSM-R Integrated Fixed-line Dispatcher System (IFDS) from Siemens Convergence Creators, called IFDS GSM-R dispatcher later in this document, is a fixed line dispatching solution built specifically for diverse controller positions in the railway environment. It is fully compliant to the latest EIRENE (FRS 7.3 and SRS 15.3) and MORANE standards.

- Functional Numbering with FN parsing
- Group Call and Broadcast Call with specific handling
- Two-click speed REC and PEC calls with automatic phone book filtering
- MLPP support with Call Priority Handling and Optical Priority Distinction
- DSD and Controller Alerting support
- Shunting user mode with specific PTT support
- Call Transfer Support
- Call Forwarding Support (CFU, CFB, CFNR, CFNRc)
- SMS messages to MSISDN or FN

The Siemens IFDS system's performance values are adhere to the GSM-R standards. Most of the premium enhancements and comfort features are integral parts of the solution thanks to the right IFDS architecture.

The Siemens IFDS GSM-R dispatcher solution provides railway operators a highly available, reliable and ensured solution system offering an intuitive easy to use GUI to manage the complete voice and text messaging communication among various control centers and coworkers in the field, such as drivers, signalers, track workers and shunters. It can be used in, e.g.:


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- dispatching centers for the controlling and handling of entire fleets of subscribers,
- centers of effective alarm and control functions,
- centers for managing train traffic, shunting issues, power supply and other railway affairs,
- emergency center for handling railway specific, public and other emergent events,
- other management and operational centers.

The key-factors below were carefully considered during the design and implementation of IFDS GSM-R dispatcher solution, which distinguish this solution from other classical operational communication systems and PBX-systems:

- Seamless interworking with GSM-R infrastructure networks
- Complete compliance to the latest EIRENE and MORANE specifications
- Provision of all basic and supplementary services of GSM-R
- Provision of enhanced intelligent services like dynamic train lists and role management
- Completely IP-based solution internal architecture without conventional circuit switchers
- High reliability via redundancy

## 1.2.2 Distinct Characters and Customer Benefits

IFDS GSM-R dispatcher solution of Siemens Convergence Creators is feature-rich, highly scalable, reliable and completely compliant to the latest version of EIRENE FRS and SRS as well as related MORANE specifications. Comparing to other similar products in the market, it is distinguished by the characters described in the following paragraphs, which bring clear benefits to customers.

### 1.2.2.1 Premium enhancements and comfort features

The integral parts of the solution are the enhancements and the comfort features on the top of the mandatory EIRENE feature set:

- **Flexible role management**
  IFDS offers very flexible role management system, enables administrable assignment of multiple roles to the controller. The assignment type can be exclusive, parallel or personal.
  Language support can be anytime freely selected in the dispatcher client application. Every controller user can select
  - In parallel mode, multiple controllers (users) can act in parallel in the certain dispatcher role; incoming calls are routed to incoming queue of both users, and are primarily auto-answered to the user with lower workload.
  - Exclusive role is the safe support of the shift change. Login of one controller to specific role leads to logout of the controller which was till then logged in that role. The active calls to this role are kept and presented to the newly logged controller.
  - Personal role is special controller role (CT7 number) assigned to the person. The number is administered in the phonebook and the controller user is always reachable under this functional number, independently on in which controller role is currently logged in.

- **Language support**
  Language support can be anytime freely selected in the dispatcher client application. Every controller user can select the user interface language and the language will be immediately switched over. The language like all other settings is used during login from another terminal.

- **Instant recording**
  All voice communication made by the controller, is also instantly available. Playback possibility is very useful feature for recap the call details.

- **Multi-network conferences**
  IFDS is capable to create conference from incoming also from outgoing calls. There is also capability to include into conference the subscriber from different networks – GSM-R, Tetra, PSTN. Calls and conferences with government TETRA network and public GSM network are very useful in the emergency situations.

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- **Call-loops detection and elimination**
  IFDS is capable is capable to identify and prevent the situation, where the user is logged into multiple roles where two of this roles are involved in the same call. After picking up the cole by one role, the call for other role disappears for this user, to prevent audio looping.

- **Action-enabled Event Log**
  To the controller is anytime available full action enabled event log. Events are available for the user, for the role he is logged in al for his all current roles. IFDS offers extensive sorting and filtering possibilities. For the call related events are within event details available call-reply or reply-with-SMS actions, as well as instant recording playback action directly from event log. For SMS related actions the SMS reply actions are available.

- **Notification bar**
  On the user interface is well visible status and notifications like missed calls, new SMS or DSD notifications, controller alerts or activated call forwarding. This allows one-look overview about status.

- **Functional wizard**
  Functional wizard simplifies creation of the functional number step-by-step. As additional support, the wizard offers only those entities (trains, shunters) which are available from the registrations from the IN interface.

- **Multi-network rich phone book**
  Phone book contains identities from all networks controlled by IFDS. Tetra, GSM-R, GSM also PSTN identities can be searched, filtered and called by few-click actions. Prepared filtering by GSM-R call-type, or by simple color tag (red, green, yellow and blue) enhances the existing traditional favorites principles. Favorities can be organized into configurable multiple screens, role and user specific.

- **Architecture enabled high system limits**
  There are no hard limits to the system phone book, incoming or hold queue or the active calls. The meaningful limits can be setup for the specific deployment.

- **Control Area view**
  There is specific view available for the controller. In this view are displayed only objects (trains, mobiles) which are located in the controller's control area(s). this provides the dynamic overview about the area in the controllers responsibility.

### 1.2.2.2 A Future-Oriented Solution Based on IP-Technology

The interface for voice communication between a fixed line GSM-R dispatcher and a GSM-R NSS, as being standardized in the current EIRENE specifications, is ISDN-PRI over E1. IFDS GSM-R dispatcher uses this interface to connect to MSC/MGW of GSM-R NSS to implement various standardized voice calls. Except this interface IFDS GSM-R dispatcher is built based on IP technology. All the internal components of the IFDS GSM-R dispatcher system are connected to each other by IP. The external interfaces like the interface used to communicate with the IN-part of the NSS to implement location-related functions and servers as well as the interface used to connect to SMSC of the NSS to enable SMS-based text communication are all IP-based.

All-IP is the clearly widely accepted technical trend in the telecommunication industry and market. It is almost impossible nowadays to find any example of any standardization institutions of telecommunication industry and academy, where IP is not used as the basic technology in defining any telecommunication-related solutions for the near future. IFDS GSM-R dispatcher solution of Siemens Convergence Creators follows this trend. Its IP-based internal architecture and packet-switch-based message routing


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strategy ensure an easy and smooth migration to the all-IP world in the future and protect customer's investment today in the future.

A widely spoken phrase today is "everything over IP and IP over everything". This reflects the fact that there are IP-based solutions for almost all challenges concerning telecommunication and there are efficient solutions enabling IP-packet-transportation over any existing non-IP technology, like SDH and frame-relay. The IP-based internal architecture of IFDS GSM-R dispatcher solution can be also implemented efficiently on top of any existing legacy data transportation networks of customers.

### 1.2.2.3 COTS Hardware

IFDS GSM-R dispatcher solution is designed from the very beginning to run at COTS hardware. Comparing to using vendor-specific proprietary hardware, using COTS hardware brings customers very clear advantages:

- Main-stream COTS hardware products in the market are all of state-of-the-art, widely proved, compliant to all related international or national standards, cost-effective and with excellent service networks.
- Customers are independent from any single vendors and the vendor-related risk can be reduced to minimal.
- COTS hardware products are usually well-modularized. Similar COTS products compliant to same set of standards are compatible to each other. This provides much more flexibility and scalability for customers to adapt the dispatcher solution flexibly to meet their changing demands.
- Ergonomic and comfort Full HD 22" screen well suited for the standard operation as well as small 15" screen foreseen for the limited functionality controllers are supported in the same system.

### Thick Server and Thin Client Architecture

IFDS GSM-R dispatcher solution of Siemens Convergence Creators is built on top of a multi-technology and multi-vendor platform (more in Chapter 1.2.2.4), where client/server architecture is applied. Client/server architecture is a well-known modern design pattern in developing complex multi-process IT application systems. It makes the design, implementation and operation of the central servers and distributed clients relatively independent to each other and promotes flexibility, scalability and fault-tolerance.

After careful and thorough study, the method of thick servers and thin clients are chosen. Comparing to "thin servers thick clients" this technology move the complicated and sensitive data management and business logic to the powerful central servers and makes the clients only simple operation terminal handling graphic and audio user interfaces. In the environment of railway operations, where GSM-R is applied, only a very few centrally installed servers are required while a lot of distributed client operation terminals are demanded. In general it is easier and more cost effective for customers to ensure and to maintain the security, availability, reliability, safety, and operation continuity of a few centrally installed servers than of many widely distributed client terminals.

Taking the security issues of physical access to sensitive and critical data as an example, it is for sure much easier and more cost-effective to secure the physical access to several centrally installed servers than to guard many client operation terminal distributed geographically in different offices.

### 1.2.2.4 Multi-technology and Multi-vendor Platform

IFDS GSM-R dispatcher is a GSM-R specific dispatching solution designed on top of the multi-technology and multi-vendor dispatcher platform of Siemens Convergence Creators. Independent of communication technologies and application areas, most of the dispatching systems have a lot of common tasks and

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characters. One of their main tasks is to enable effective and efficient voice and text communications among central dispatching operators and their professional co-workers in the fields.

Role management is a common feature required by all dispatcher solutions involving multiple dispatcher co-operators sharing same jobs or in charge of different tasks. Effective and efficient role management provides dispatcher operators suitable and comfortable working environment specifically designed for their working roles, which, when required, is independent to their current working places and operation terminals. It also enables an operator to switch quickly between different roles.

Security management, fault management, basic look-and-feel handling and subscriber management are other examples of common requirements of various dispatching systems. Redundancy techniques used to provide high available and reliable electronic systems, geographically duplication of operation sites to ensure business continuity against catastrophes and scalable system architecture to adapt solution capacity exactly to customer's needs are also common features shared by dispatching solutions based on different communication technologies and applied in different areas.

The IFDS multi-technology and multi-vendor dispatcher platform of Siemens Convergence Creators provides a perfect solid basis for develop efficiently and quickly solutions designed exactly for the specific communication technology and for the specific needs of customers in different branches. IFDS GSM-R dispatcher is such a dispatching solution developed on top of IFDS, which is designed specifically for using GSM-R communication technology and to meet specific and special needs of railway operations.

IFDS provides an effective and efficient basis to share experiences and knowledge created and collected in different branches, from different application areas, for different customer projects, in different environment and using different technologies within Siemens Convergence Creators. A failure detected in a wind-park project can be prevented in a railway project. An excellent GUI design for a TETRA project can be simply reused in a GSM-R project. The experience obtained by developing a solution with geographically duplicated operation sites in Middle East can be re-applied in any project with similar requirement in Europe. IFDS enables Siemens Convergence Creators to keep learning and improving its dispatching solutions from project to project in different branches, for different applications, using different communication technologies, dealing with equipment from different vendors and for different customers in different environments. This multi-technology and multi-vendor platform is one of the key factors enabling us and ensuring us to offer perfect GSM-R dispatching solutions for railway operations.

# 2 Structure and Architecture

## 2.1 IFDS GSM-R Dispatcher System Architecture

### 2.1.1 IFDS Platform

The IFDS GSM-R dispatching system of Siemens Convergence Creators is a specific dispatcher solution developed on top of Integrated Fixed Dispatching System (IFDS), a multi-technology and multi-vendor platform of Siemens Convergence Creators enabling design and development of dispatcher solutions based on different communication technologies like GSM-R, TETRA, VoIP, PSTN, 3G as well as 4G for different application areas like railway operation, mass transportation, airport management, public security, energy generation, oil & gas as well as diverse military projects. IFDS sets up a solid basis to share experiences and knowledge created and collected in different branches, from different application areas, for different customer projects, in different environment and using different technologies. It ensures constant and consistent top quality and high efficiency of all technology-specific dispatcher solutions designed and developed by Siemens Convergence Creators for specific customer projects in specific application areas and environments.


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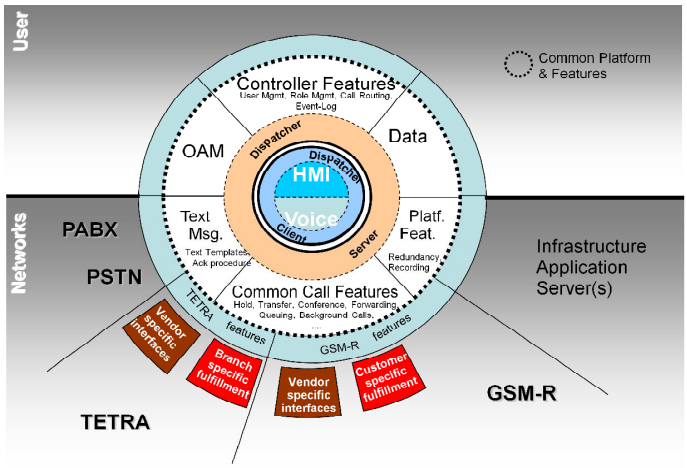


**Figure 2-1: Architecture of the IFDS platform**

Figure 2-1 shows the basic structure of IFDS, which is developed based on the server/client architecture with thick and intelligent central server system and multiple thin and simple distributed client operation terminals.

The main tasks of an operation client of IFDS are

- to provide simple, direct, intuitive and comfortable interfaces to dispatcher operators, including GUI and audio equipments;
- to ensure secured access to and data communication with the central server system.

The main tasks of the central server system of IFDS are

- to handle business data and processing logics;
- to ensure security, performance, scalability, availability, reliability and continuity;
- to handle subscriber-related issues, e.g. authentication, authorization, subscriber's home environment settings and other subscriber-specific data;
- to handle technology-specific issues and
- to handle vendor-specific issues.

The some advantages and benefits of this system architecture are discussed in Chapter 1.2.2.4 and Chapter 0.

## 2.1.2 GSM-R Dispatcher Solution

IFDS GSM-R dispatcher solution is designed and developed, on top of the IFDS platform, specifically for railway operations using GSM-R mobile communication technology, as specified and standardized in EIRENE and MORANE projects. It is fully compliant to all related standards from EIRENE and MORANE.

Figure 2-2 shows the solution architecture of IFDS GSM-R dispatcher solution of Siemens Convergence Creators.

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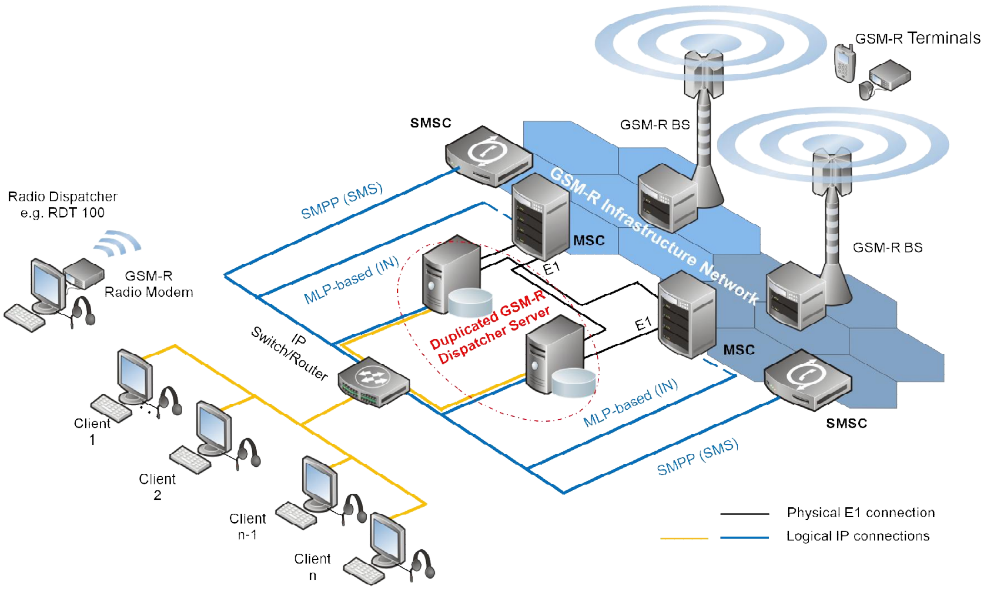


**Figure 2-2: Architecture of IFDS GSM-R Dispatcher Solution**

As discussed above, IFDS is built based on the server-client architecture with a thick central server system and multiple distributed operation clients. This structure is inherited by IFDS GSM-R, which consists of basically a central highly available and reliable server system, supporting system redundancy, and multiple distributed operation client terminals. Details on the server redundancy are discussed in Chapter 2.2.

The function components of IFDS GSM-R dispatcher can be classified basically into two groups, i.e. the central function platform group and the operation client function group, as shown in Figure 2-3.

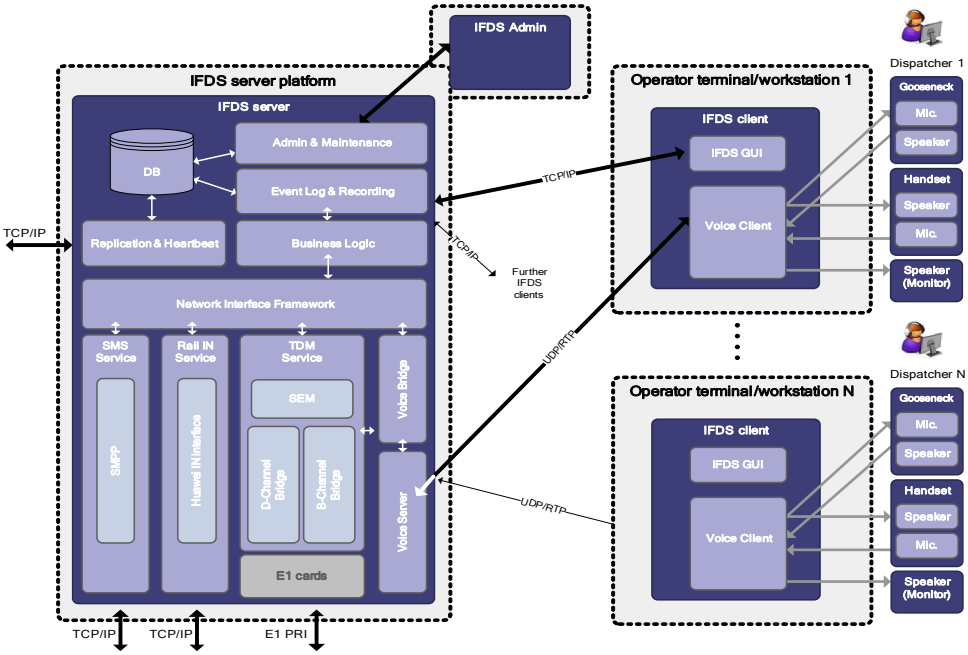


**Figure 2-3: Functional components of IFDS GSM-R**

The main function of the operation client group is to provide dispatcher user interfaces, including:


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- the GUI, which provides user friendly and fast access to all necessary information in one view and ensures straight forward access to the control functions needed to manage the voice and text communication to diverse GSM-R mobiles in the concerned control area,
- and Voice-control application, which drives audio signals from and to the consoles sound-card/headset/speaker.

The central function platform group manages all data related to groups as well as individual subscribers provisioned in the GSM-R network. It facilitates the organization and management of the subscriber's voice and SMS communication. It also provides data-management and a central database for data like phonebooks, favorites, SMS text templates etc. Regarding voice, the server is responsible for performing audio mixing, volume control, tone-generation, file-recording and streaming to the clients, etc.

Internally in the IFDS GSM-R solution all components are connected to each other over IP. This includes connections

- among different servers, e.g. installed
  - for the purposes of hardware and geographical duplication against single-point physical failures and single-site catastrophes to improve availability, reliability and business continuity
  - or due to load balance and distribution to ensure operation performance and system scalability;
- between an operation client and the central server system;

More about the internal interfaces of IFDS GSM-R can be found in Chapter 2.4.2.

IFDS GSM-R needs 3 interfaces to connect to the GSM-R mobile communication infrastructure network, as shown in Figure 2-2, for different purposes:

- Mandatory E1 interfaces to enable voice communication over the GSM-R infrastructure network. Currently ISDN-PRI interface running over E1 is the only interface standardized in EIRENE specifications to enable voice communication. A single E1 interface supports 30 full-duplicated voice communication channels. It connects the IFDS GSM-R server system to MSC/MGW of the GSM-R infrastructure network. Since voice communication is required mandatorily by EIRENE and MORANE, this interface is mandatory for IFDS GSM-R.
- Mandatory SMPP/IP interfaces to enable text/SMS message communication over the GSM-R infrastructure network. Currently SMPP over IP is the only standardized interface enabling text message communication over SMS. It connects the IFDS GSM-R server system to SMS-Centers of the GSM-R infrastructure network. Since text message communication over SMS is required mandatorily by EIRENE, this interface is mandatory for IFDS GSM-R.
- Optional proprietary interfaces to enable widely required features of operation intelligence. Though not clearly required in any EIRENE or MORANE standard specifications, some basic features enabling railway operation intelligence are widely required. One of the examples is the dynamic train-mobile-list, which requires providing dispatcher operators the dynamic list of all the trains and other GSM-R mobile stations currently running in the geographic areas controlled by these operators. Another example is the dynamic registration of dispatcher operators to enable dynamic LDA within the GSM-R network. For the purpose of railway operation intelligence, IFDS GSM-R proposes an IP-based interface based on MLP defined by OMA to connect to the IN-functions of NSS of the GSM-R infrastructure network. Since operation intelligence is not clearly required by EIRENE and/or MORANE, this interface is optional for IFDS GSM-R.

More about the external interfaces of IFDS GSM-R can be found in 2.4.1.

GSM-R mobile radio dispatchers, like RDT 100 from Siemens, can be used to complement IFDS GSM-R.

## 2.2 System Redundancy

### 2.2.1 Principles

Homogeneous hardware redundancy is a widely used and well-proven fault-tolerant technique against single-point physical failures like diverse transient or permanent hardware breakdowns. Geographically

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distributed redundant hardware components can be used to against various site-catastrophes to ensure business continuity.

The hardware redundant system applied in IFDS is in principles a 1:N master-slave solution ensuring high availability and reliability. It consists basically of one active master and one or more passive slaves. During normal operation the master provides all computing power and carries out all the tasks and functions. All the slaves observe the operation and performance of the master via its heart-beat over duplicated IP-connections and keep themselves synchronized to the master. When the master fails to work properly, it will be detected by the slaves immediately and be isolated for replacement or repair. One of the slaves will be elected as the new master and takes over the normal operation. This process is instant and fully automatic.

As shown in Figure 2-2, the server system of IFDS GSM-R is a 1:N (typically 1:2) redundant system. All the client operation terminals keep connecting automatically to the current active master via its virtual IP-address, which hides the details of any server- mastership-switchover from dispatcher operators.

### 2.2.2 Flexible Architecture

Various redundancy concepts and configurations can be implemented based on the flexible redundancy architecture of IFDS GSM-R, according to specific requirements and strategies of customers regarding availability, reliability and failure-tolerance. Examples of typical redundancy structures are:

- Single server without redundancy;
- Single server with duplicated key-components;
- Duplicated servers at one site;
- Duplicated servers with each server at a different site (with or without duplicated key-components);
- Two operation sites with each site equipped with two fully duplicated servers (hot-standby or cold-standby).

When multiple geographically distributed operation sites are required, the operation-switchover among the sites can be done either automatically (hot-standby) or manually (cold-standby).

When hot-standby is applied, the redundancy system works basically in the same way as at a single site. The duplicated IP-connections among the different operation sites ensure synchronization between the active master servers and all passive slave servers and the master-election algorithm guarantees that an automatic site-switchover will take place when and only when the current master operation site fails completely. When there are slave servers running at the same operation site as the current master server, a site-internal mastership-switchover will take place if the current master fails.

The main advantage of hot-standby is the fast and smooth automatic operation switchover between different operation sites. This ensures the seamless operation continuity in the case of a site catastrophe. The main disadvantage of this redundancy operation mode is mode demands to resources during normal operation, including both material and human resources.

Cold-standby is the opposite of the hot-standby. The server system at the standby-site is basically switched-off during normal operation, except a network-attached-storage being used to keep synchronization to the master-server at the remote operation site. Site-switchover can be done only manually and will require typically more than 30 minutes. The main advantage of cold-standby is the lower demand to resources during normal operation.

### 2.2.3 An Example

If required, two dispatcher server systems can be used. One system (active) is located at the primary site, while the other (cold stand-by) is located at the back-up site. Either the server system on the primary site or that at the backup site can be active at the same time. The key data of the active system are mirrored automatically on a NAS device available for the ‘cold stand-by’ system after power-up.

The IFDS servers are fully redundant, tolerating single point failure. Duplicated servers, duplicated interfaces and a duplicated power supply are used. If a component fails, the system will initiate an automatic switchover of the failed component.


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Both the primary and the back-up sites contain duplicated IFDS GSM-R servers that are operating in redundant mode, with one as the master server and the other as the slave server, which constantly monitors the master and automatically (or on user request) takes over the role of the master server when it fails.

The IFDS operation clients run in the redundant configuration mode and keep connecting to the actual master server via its virtual IP-address.

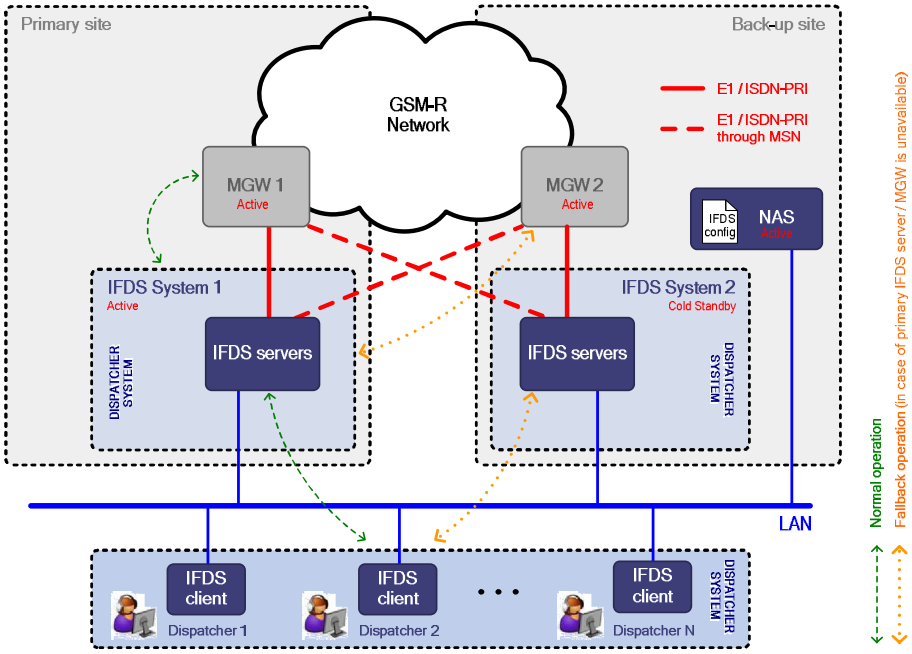


**Figure 2-4: An example of redundant IFDS GSM-R**

## 2.2.4 Seamless Maintenance or Upgrade

The redundant server architecture described above can also be used to ensure seamless maintenance and upgrade of IFDS server-cluster without influencing its normal operation. When an IFDS-server cluster, e.g. a master server plus a slave server, is to be maintained or upgraded, this work will be done at first to the standby slave server. The maintained or upgraded slave-server will take over then the mastership of the server cluster and the previous master server will become standby slave. By maintaining or upgrading this new slave-server the whole task of maintenance or upgrade can be finished seamlessly without any operation interruption of the IFDS-server cluster.

The only issue of this solution is the unavailability of the server-redundancy during the period of maintenance or upgrade. This will make the IFDS-server sensitive to single hardware failures. When necessary and when a spare IFDS-server hardware is available, the spare hardware can be used to solve this problem:

1. The spare IFDS-server is installed and replaces the current IFDS-slave-server.
2. This replaced IFDS-slave-server is maintained or upgraded.
3. The maintained or upgraded IFDS-slave-server replaces the spare IFDS-server in the server cluster.
4. The IFDS-slave-server takes over the mastership of the IFDS server cluster and the previous IFDS-master-server becomes a standby slave.
5. The new slave-server is replaced by the spare-server.
6. This slave-server is maintained or upgraded.
7. The newly maintained or upgraded slave-server replaces the spare-server in the server cluster.

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## 2.3 Main Component Elements

As described before, IFDS GSM-R dispatcher solution consists mainly of the dispatcher server system and the dispatcher client terminals, including dispatcher operation client terminals and dispatcher administration client terminal. The main task of the dispatcher server is to process all data and logics. The main task of the dispatcher operation terminal is to interface normal dispatcher operators and the main task of the dispatcher administration terminal is to interface dispatcher system administrators. All these three main components of IFDS GSM-R dispatcher solution will be described in the following chapters in details.

### 2.3.1 Dispatcher Server

#### 2.3.1.1 Server Functions

As discussed in Chapter 0, IFDS GSM-R dispatcher solution is developed based on a server /client architecture with thick intelligent server and thin simple operation clients. The central server system connects to operation client terminals as well as to administration client terminals via IP-connections. It connects to the GSM-R mobile communication infrastructure network via three standard as well as proprietary interfaces:

- E1-based ISDN-PRI standard interface for voice communication,
- IP-based SMPP standard interface for text message communication via SMS
- Optionally, IP-based MLP-oriented proprietary interface for railway operation intelligence.

More about the interfaces can be found in Chapter 2.4.

The central server system is the kernel component of the IFDS GSM-R dispatcher solution. It is responsible for processing and storing all key-data, e.g.

- subscriber data,
- operation and business data,
- configuration and system data,
- history and trace data, security data,
- performance data and
- data for fault and RAMS management.

It is also responsible for carrying out all business and operation logics. Examples of the basic function services used for implementing various dispatcher features include:

- Role management service
  In railway operations, Responsibility, capability and tasks are binding to different roles, e.g. primary controller, secondary controller, traffic controller, power controller and shunting controller as defined in EIRENE RFS and SFS. Roles can be assigned dynamically to different dispatcher operators and an operator can switch dynamically among different roles. Role management binds tightly to the security management. Role management is one of the fundamental function services of IFDS GSM-R.
- TDM service
  The TDM-service controls and manages the access to ISDN/PABX components and to the s2m PRI (EDSS.1) interface to the MSC.
- Messaging service
  The Messaging service provides IP-based communication with SMS centers based on SMPP protocol, e.g. sending and receiving SMS messages. Notifications about sent SMS messages reflect in the presentation in the event list. SMS messages can be sent also to administrable lists of predefined service areas.
- Railway specific intelligence service
  This service provides dynamic registration and deregistration of functional numbers as well as the status of all GSM-R devices within the responsible areas, e.g. the dynamic train list of a control area.
- VoIP service
  The dispatcher terminals connected to the servers via LAN/WLAN infrastructure are integrated by Voice over IP. The VoIP communication is based on RTP based media streaming.


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- Data service
  The central data service manages and keeps e.g. all user-, role- and session-related data. It ensures the integrality and consistency of all related data and enables users and roles to work at different operation terminals with consistent environment and context.
- Log and recording service
  This service logs and records in a secured way all the events, text messages and voice conversations going through or taking place at the GSM-R dispatching system. It enables efficient event tracing, accident analysis, etc.
- Access service
  This service enables authentication and authorization management, which is required by dispatcher subscriber management, role management and session management, etc.
- Redundancy service
  This service provides the fundamental service primitives to ensure data synchronization between master and slave servers running in redundancy mode, to enable runtime-monitoring of the operation status of the master server and to enable seamless automatic mastership-switchover when the master fails.

### 2.3.1.2 Server-cluster

Depending on performance and reliability requirements, an IFDS GSM-R dispatcher server system may consist of different components. Figure 2-5 shows the construction of a typical IFDS GSM-R dispatcher server cluster, which consists of

- 2 simple dispatcher servers including additional E1 interface equipment,
- An automatic protection switch (APS) and
- A network attached storage (NAS).

#### 2.3.1.2.1 Basic Component Functions

The 2 dispatcher servers build a master-slave redundant system tolerating any single-point hardware failures. The 2 dispatcher servers are connected to each other via physically duplicated IP-connections. Except the implementation of the IP-network, there is basically no difference to the implementation of the dispatcher server-cluster if the 2 servers are geographically distributed or not.

During normal operation all the operation tasks are carried out by the active master server. The slave server is logically connected only to the master server via physically duplicated IP-connections. It observes constantly the heart-beat of the master server and keeps itself synchronized with master server. When the master fails, the slave takes over the mastership of the cluster automatically and immediately.

Both 2 dispatcher servers are equipped with additional E1 interfaces physically, which are used to connect to the GSM-R infrastructure network (MSC or MGW) to enable voice communication over the GSM-R mobile communication network. One physical E1 interface provides 30 bidirectional voice channels. Depending on customer's requirements of voice communication capacity, multiple E1 interfaces can be installed.

The SMS-based text message communication is enabled by the IP-connection to the SMS-Center via SMPP and the railway operation intelligence is enhanced by the IP-connection to the NSS IN-function of the GSM-R infrastructure network via a MLP-based protocol.

Both 2 dispatcher servers are administrated by one or more local or remote administration client terminals, which are connected by IP.

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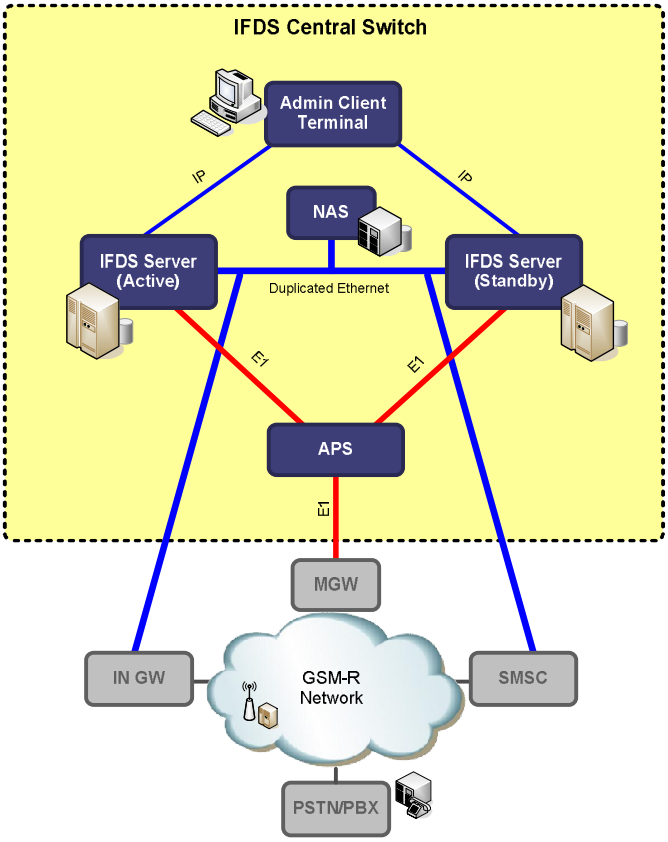


**Figure 2-5: Construction of an IFDS GSM-R dispatcher server-cluster**

The basic function of the automatic protection switching equipment (APS) is to switch all the related E1/ISDN-PRI interfaces from the MSC/MGW of the GSM-R infrastructure network automatically to the active master of the dispatcher server-cluster. The slave of the dispatcher server-cluster is isolated.

The network attached storage (NAS) is required only for the redundant solutions involving cold-standby servers or operation sites. Its main task is to store real-time data to keep synchronized to the active master server and to make them available for the cold-standby servers by starting-up.

#### 2.3.1.2.2 Server Software Components

Main software components of a IFDS GSM-R dispatcher server are shown in Figure 2-6.

Dispatcher server application software

The main task of the GSM-R dispatcher application software running at the dispatcher server is to implement and to provide all general and railway specific operation logic and business intelligence. Except diverse user operation interfaces (e.g. GUI and audio interfaces) all the functionalities, features and services are implemented in the GSM-R dispatcher server application software system. More details on these functionalities, features and services can be found in Chapter 3.

Technical computing suite

- Middleware
  The middleware provides an interface to the operating system and to the communication hardware (Sangoma E1). It includes a carrier grade ISDN stack and primitive software functions required to implement TDM service of the GSM-R dispatcher application software. This enables the effective and efficient message communication between the GSM-R dispatching system and the GSM-R infrastructure network via ISDN PRI interfaces.


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Further middleware components are tools and libraries as, for instance, used for logging purposes.

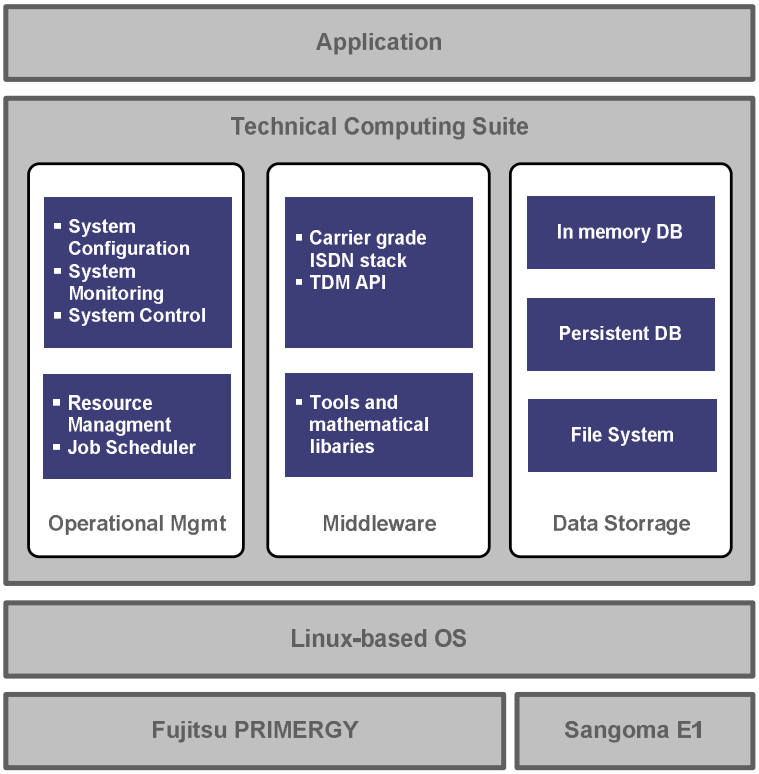


**Figure 2-6: IFDS GSM-R dispatcher server software components**

- Database system and data services
  Database system is required to implement the data service of the GSM-R dispatcher system. More about data service can be found in Chapter 2.3.1.1.
- Operational management and services
  This package provide basic primitives and tools to enable effective and efficient task schedule and computing resource management of the GSM-R dispatcher server. It ensures also runtime system state monitoring, which is required to implement fault-switchover within a redundant GSM_R dispatcher server cluster.

Operating system

IFDS uses a Linux based operating system. The operating system connects the hardware and the application software and provides general primitive computing services for the middleware and software applications.

Native E1 card drivers

The native E1 card drivers provide primitive functions enabling the related middleware and application software to access and to use the E1 card from Sangoma. More details can be found via http://sangoma.com/products/telecom_boards/digital/a102.html.

### 2.3.1.3 Server Hardware

IFDS GSM-R dispatcher solution of Siemens Convergence Creators is designed and implemented for using COTS hardware from very beginning. As discussed in Chapter 1.2.2.3, customers can benefit much from this characteristic. In the following paragraphs recommendation will be made for choosing hardware for dispatcher server components.

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#### 2.3.1.3.1 Basic Server Hardware

As shown in Table 2-1, two kinds of hardware are required to implement a simple IFDS GSM-R dispatcher server. They are the basic server equipments and the E1 interface cards.

| Component | Description |
|---|---|
| Basic server equipment | A normal powerful COTS computer server running Linux. It is the central switching element of the GSM-R dispatcher system and provides all the necessary computing power for implementing all the services and features, mainly via software applications. |
| E1 interface card | It implements multiple standard ISDN-PRI interfaces connecting the central the dispatcher server to the related MSC/MGW of the GSM-R infrastructure network. The E1 interface cards are integrated into the basic server equipment via standard PCI-Express interfaces. |

**Table 2-1: Basic dispatcher server hardware**

Basic server equipment

In principles, the basic server equipment can be any COTS computer server running Linux and offering enough computing power. The currently recommended basic server equipment is Fujitsu PRIMERGGY RX300 S7 Dual socket 2 U rack server.

Figure 2-7 shows the front-side and the back side of Fujitsu PRIMERGGY RX300 S7 Dual socket 2 U rack server:

**Figure 2-7: Fujitsu PRIMERGGY RX300 S7 Dual socket 2 U rack server**


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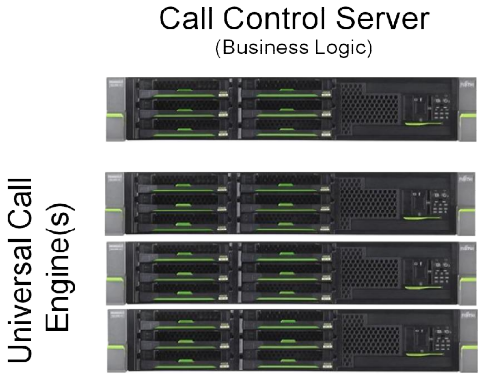


**Figure 2-8: Load distribution among multiple servers**

Fujitsu PRIMERGGY RX300 S7 servers can be easily configured to meet different performance and reliability/availability requirements, as shown in Figure 2-9. When required for very large dispatching systems, IFDS GSM-R dispatcher server can use multiple servers and distribute different tasks to different servers to keep load balance and to achieve required performance, as shown in Figure 2-8.

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Figure 2-9 shows the configuration diagram of Fujitsu PRIMERGGY RX300 S7:

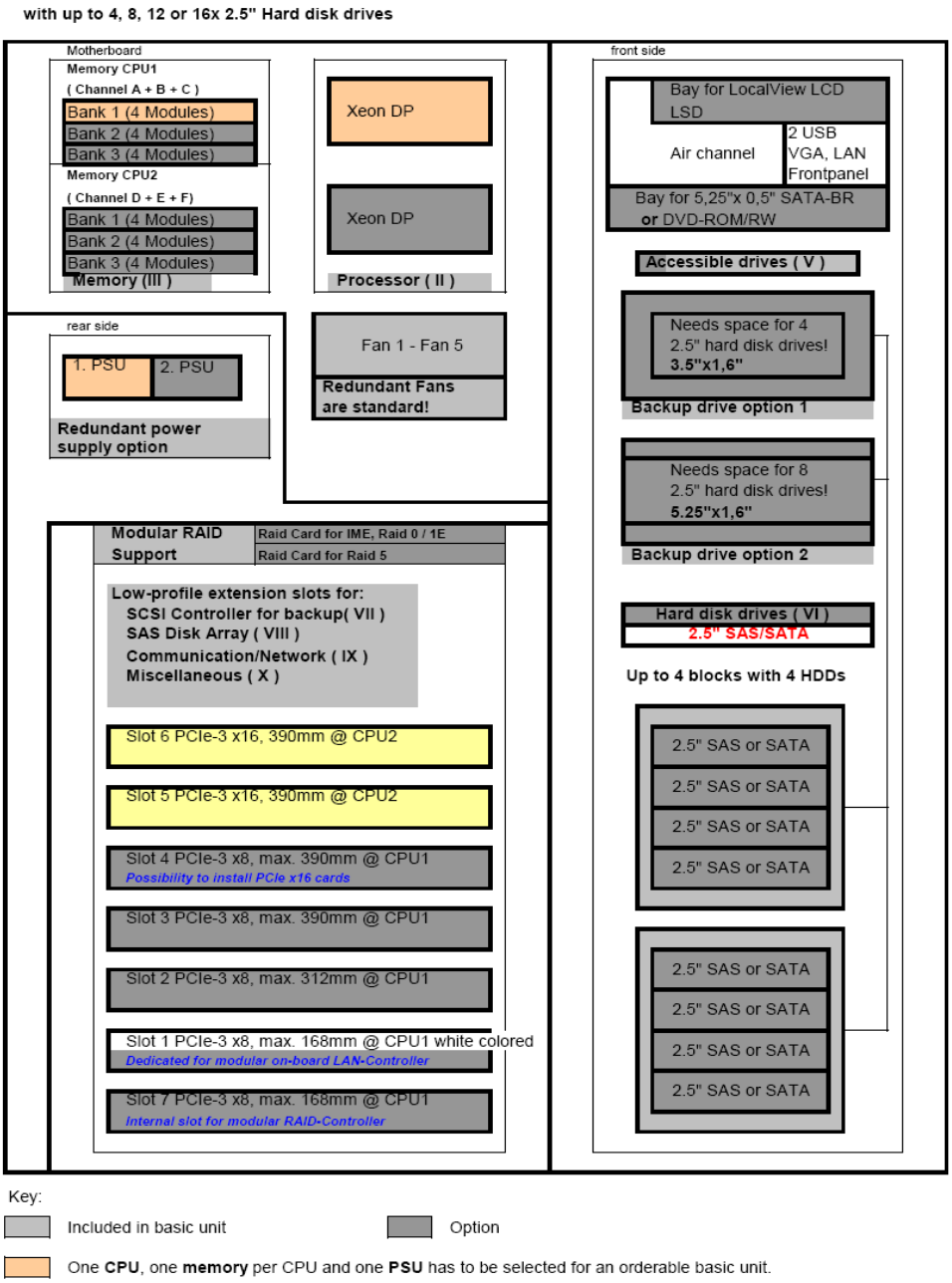


**Figure 2-9: Possible configuration of Fujitsu PRIMERGGY RX300 S7 server**

More details about Fujitsu PRIMERGGY RX300 S7 Dual socket 2 U rack server can be found at http://www.fujitsu.com/fts/products/computing/servers/primergy/rack/rx300/

E1 interface card

The E1 interface cards recommended currently are the widely used COTS products from the company Sangoma.


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Figure 2-10 shows "A102DE" card from Sangoma, supporting 2 E1 ports.

**Figure 2-10: Sangoma E1 card A102DE with 2 ports**

More details about A102DE card can be found at
http://sangoma.com/products/telecom_boards/digital/a102.html

#### 2.3.1.3.2 Special Hardware for Redundancy

As discussed before in Chapter 2.3.1.2.1, for implementing various redundancy solutions, additional equipments like APS and NAS are required.

Automatic Protection Switches (APS)

The main function of APS is to switch all the related E1/ISDN-PRI interfaces from the MSC/MGW of the GSM-R infrastructure network automatically to the active master of the dispatcher server-cluster. APS provides protected E1 interfaces between the GSM-R dispatcher server cluster and the GSM-R infrastructure network. It ensures that it is the master server of a redundant GSM-R dispatcher server cluster which communicates to the GSM-R infrastructure network.

The automatic protection switch currently recommended is a widely used COTS equipment from the company Orion Telecom Network Inc, as shown in Figure 2-11.

VCL-SafeComm, 8 E1 Links (24 E1 Ports)
1+1 Automatic Protection Switching (APS)

**Figure 2-11: APS from Orion Telecom Network Inc**

More about the APS equipment can be found at
http://www.valiantcom.com/aps/safecomm/e1_8_links.html

Network Attached Storage (NAS)

As discussed before in Chapter 2.3.1.2.1, NAS is only required for the GSM-R servers installed at a cold-standby backup site, which stays down during the normal operation.

During the normal operation of the primary site, the master server keeps writing data into the NAS at the backup site, which enables the GSM-R dispatcher servers at the backup site to synchronize themselves immediately after starting up to the latest operation state of the primary site. This ensures the business continuity after the dispatcher operation is manually switched over to the backup site, e.g. due to fatal failures at the primary site.

The network attached storage can be any normal COTS massive storage equipment which can be attached directly to an IP network and offer required capacity and reliability.

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## 2.3.2 Operation Client Terminals

### 2.3.2.1 Operation Client Functions

As discussed in Chapter 1.2.2, IFDS GSM-R dispatcher solution is developed based on a server /client architecture with thick intelligent server and thin simple operation clients. It is designed from very beginning to run at COTS hardware.

The operation client terminals connect to the central server system via IP. Their main tasks are:

- To provide an effective and efficient GUI for the dispatcher operators and to ensure secured access to the central server system;
- To drive and to control the audio equipment required for voice communications.

Main software components of an operation client terminal are shown in Figure 2-1.

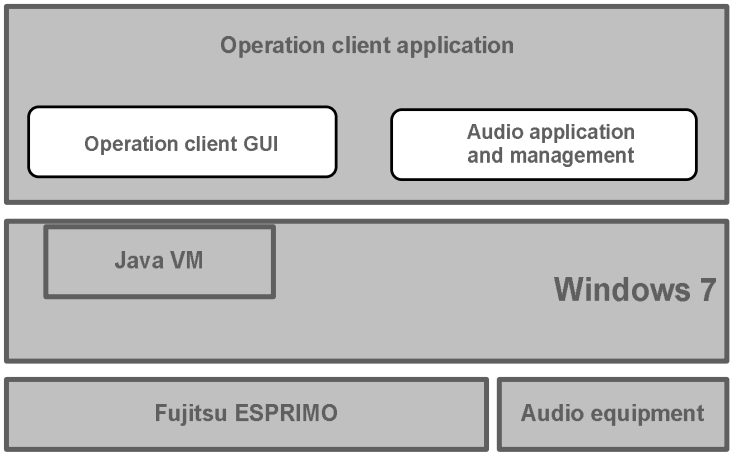


**Figure 2-12: GSM-R operation client software architecture**

Dispatcher client application software

The main task of the application software running at GSM-R dispatcher clients is to provide effective, efficient and comfortable interfaces for dispatcher users, including GUI and audio interface. The business intelligence and operation logic are implemented in dispatcher servers.

Operation client user-interfaces

The operation client GUI is implemented in Java. A snapshot of the GSM-R dispatcher operation client GUI is shown in Figure 2-13.

The graphical user interface offers all necessary means for users to do and to manage voice and text message communication, including:

- Areas showing the identifier of the active user, the registered and the active roles and the current service status of the operation client;
- Areas for queuing and handling voice calls, including incoming calls, calls on hold and active calls;
- An area for handling voice- and phone-specific functions;
- An area for managing general dispatching functions;
- An area providing terminal-specific tools;
- An general working area handling, e.g.
    - Phone book with filter-functions
    - Intelligent dialing wizard
    - Dynamic train/mobile-list


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- An area for handling SMS text message communication;
- An area showing history of all events logged at this operation client terminal;
- High-lighted operation buttons for starting REC (railway emergency call) and PEC (public emergency call).

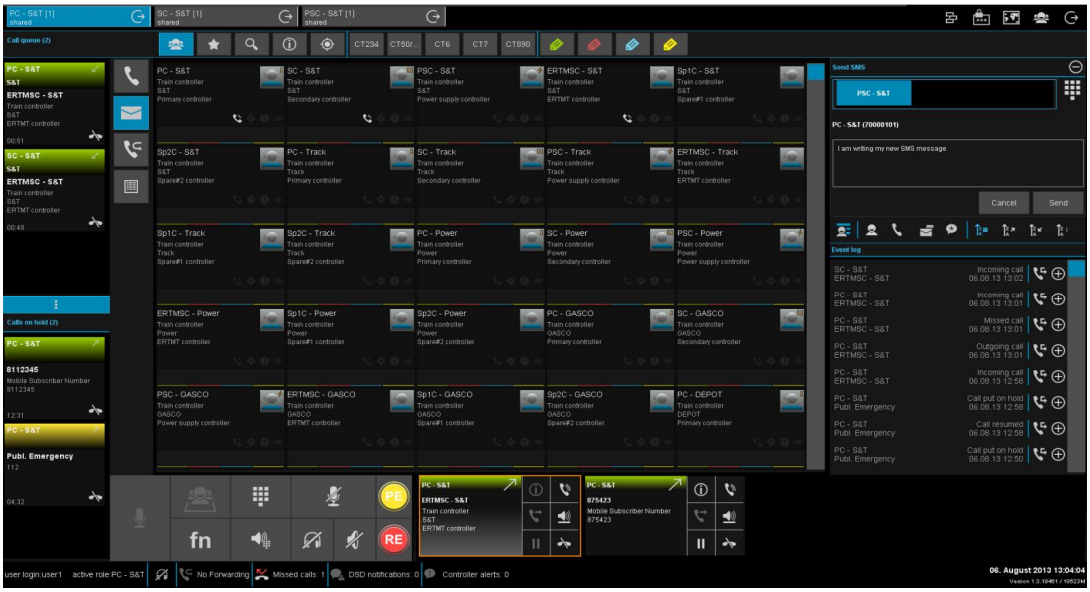

**Figure 2-13: GSM-R operation client GUI**

Other functions supported by an operation client terminal including:

- Indication of ongoing and missed events;
- Enhanced Drag and Drop Control capability;
- Touch-screen support;
- Multi language support;
- User authentication and security services;
- Pre-configured ring tones, etc.

Audio user-interface is realized mainly by the audio equipment described in Chapter 2.3.2.3.

Operating system: Windows 7

The operating system connects the hardware and the application software and provides general primitive computing services for the middleware and software applications.

Middleware: Java VM

GSM-R dispatcher operation client GUI is implemented in Java. JavaVM is required to make Java code run.

Native audio equipment drivers

The native audio equipment drivers are required to connecting the operation client software applications to the hardware audio equipment.

### 2.3.2.2 Operation Client Terminal Categories: Standard and Premium

Railway operation is complex and critical and requires optimal organization and team work. Operation client terminals of a GSM-R dispatching system can be used for different tasks, at different places with different working environment and by users with different backgrounds. This raises both common and specific requirements to dispatcher operation terminals, in terms of both capacity and capability. For instance, a station operator in charge of only a small railway branch doesn't need all the features required by a primary railway controller monitoring and managing all the railway traffic in a big city. To meet dif-

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ferent operation requirements and to save valuable resources, IFDS GSM-R dispatcher solution introduces currently 2 major operation terminal categories: the standard and the premium. The standard operation terminals offer a reach set of features meeting all the requirements of normal railway operation. On top of these features the premium operation terminals provide enhanced capacity and capability to meet the requirements of more system performance and operation intelligence.

Both the standard and the premium operation terminals are completely compliant to the standards and specifications of EIRENE and MORANE. They have similar requirements to hardware and differ to each other only in terms of operation capacity and features of enhanced business intelligence. In principles the enhanced features enabling operation intelligence, which depend on the support of the proprietary IN-interface described in Chapter 2.4.1.1.3, can be offered only by the premium operation terminals.

| Features | Standard | Premium |
|---|---|---|
| Total calls processed in parallel | 4 / role | 12 / role |
| Calls held | 2 / role | 4 / role |
| Members in a conference | 8 | 24 |
| Registered roles | 4 | 12 |
| Role modes | Not support | Exclusive, parallel & passive |
| Pick-up queue | Not support | Support |
| Speed-keys | 96 / role | 288 / role |
| Role configurable speed-keys | 0 | 64 |
| User configurable speed-keys | 0 | 48 |
| Favorite list | Not support | Support |
| Dynamic train & mobile list | Not support | Support |

**Table 2-2: Main difference between Standard and Premium**

Table 2-2 shows the main difference between the standard operation terminals and the premium operation terminals.


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### 2.3.2.3 Components of an Operation Terminal

A dispatcher operation client terminal consists of the client workstation, the touch screen and the audio equipment, as shown in Table 2-3. Theoretically or even in praxis the client workstation and the touch screen are different components for different tasks. The workstation provides the computing power while the touch-screen offers comfortable and efficient human-machine interface. But it is strongly recommended to use all-in-one computing equipment integrating both computing power and terminal screen supporting multi-touch.

| Component | Description |
|---|---|
| Client workstation including keyboard and mouse | This is a normal COTS computer workstation running Windows 7 operating system. It provides necessary computing power for implementing diverse user interfaces of a GSM-R dispatcher operation client terminal required to offer effective, efficient, friendly and comfortable dispatching services and features. |
| Touch screen | The screen supporting multi-touch is the screen terminal of the GSM-R dispatcher operation client terminal. Besides an effective, efficient, friendly and comfortable GUI, the touch screen terminal should equipped also with a speaker. |
| Audio equipment | The audio equipment is an integral part of the GSM-R dispatcher operation client terminal, enabling voice communication required specifically by railway operation. The audio equipment of the GSM-R dispatcher operation client terminal consists of a handset with PTT button and a gooseneck microphone integrated with a high quality speaker. |

**Table 2-3: Dispatcher operation client terminal components**

#### 2.3.2.3.1 Client Workstation and Touch Screen

Since IFDS GSM-R dispatcher solution of Siemens Convergence Creators is design and developed based on a server/client architecture with thick server and thin clients, the requirement of dispatcher client operation terminal to hardware computing power is quite limited. A typical desktop or laptop workstation nowadays provides more than enough computing resources for both standard and premium operation terminals.

**Figure 2-14: The all-in-one pc SVJ2021E9EWI from SONY**

Since the working place and space of GSM-R dispatcher operators are typical limited and a lot of dispatcher users use their fingers more frequently instead of the keyboard and the mouse to operate the dispatcher terminals directly via the multi-touch-screens, it is strongly recommended to use the so-called all-in-one workstations with integrated multi-touch screens. Such computing equipments integrate the computing resources and the multi-touch-screen in one and the same units and save much place and space. Some all-in-one-touch workstation can be set in almost any position and angle, standing, lying or

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any position in between. This makes it more comfortable for dispatcher users to work with their fingers directly at the multi-touch screens.

The all-in-one pc SVJ2021E9EWI from SONY is currently recommended. With a multi-touch-screen of 51 cm or 20 inches and an Intel® Core™ i3 processor (1.8 GHz, 3 MB Cache), it provides all what the dispatcher operation terminals need. The equipment can be set at any position and is equipped with a lithium-accumulator, which makes it easy for mobile – like a tablet. A picture of this computing equipment can be found in Figure 2-14.

More about SVJ2021E9EWI from SONY can be found at
http://presscentre.sony.eu/ImageLibrary/DownloadMedia.ashx?MediaDetailsID=226903.

Another computing equipment can be currently recommended for dispatcher operation terminal of IFDS GSM-R is the all-in-one desktop with multi-touch screen ESPRIMO X913-T from Fujitsu. Except mobility it has all related characteristics of the all-in-one pc SVJ2021E9EWI from SONY. With a 23 inch multi-touch-screen and an Intel® Core™ i5 processor it provides even more computing power and resources. Pictures of this equipment can be found in Figure 2-15.

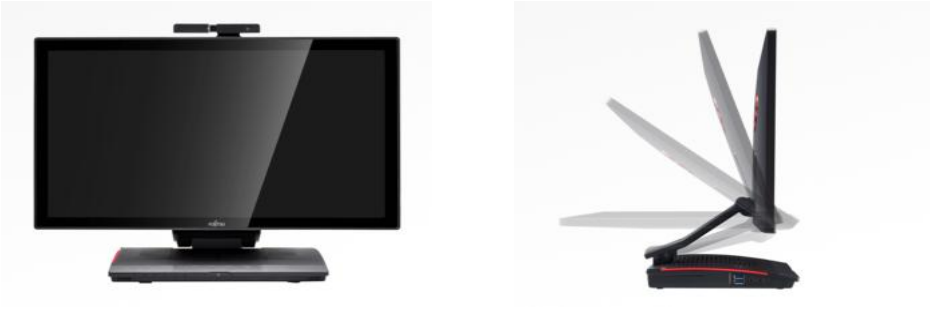

**Figure 2-15: The all-in-one desktop ESPRIMO X913-T from Fujitsu**

More about the all-in-one desktop ESPRIMO X913-T from Fujitsu can be found at

http://www.fujitsu.com/fts/products/computing/pc/desktops/superior/esprimo-x913-t/.

#### 2.3.2.3.2 Audio equipment

The audio equipment of an IFDS GSM-R dispatcher operation client terminal consists basically two parts

- A handset with PTT button and
- A Gooseneck microphone with speaker box and PTT button.

##### 2.3.2.3.2.1 Handset with PTT button

**Figure 2-16: Handset with PTT button**


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For the handset with PTT button of IFDS GSM-R dispatcher operation client terminals, the stand-alone USB handset module (TM-HUM-5AW) from the company Tripo is recommended, which can be physically and electronically seamlessly integrated with the gooseneck microphone with speaker box described in Chapter 2.3.2.3.2.2.

A Picture of the stand-alone USB handset module (TM-HUM-5AW) from the company Tripo is shown in Figure 2-16. More details of this audio equipment can be found at http://www.tipro.net/ecataloque/handset/.

#### 2.3.2.3.2.2 Gooseneck microphone with speaker box and PTT button

For the gooseneck microphone with speaker box of IFDS GSM-R dispatcher operation client terminals, the stand-alone speaker box module from the company Tripo is recommended, which can be physically and electronically seamlessly integrated with the handset with PTT button described in Chapter 2.3.2.3.2.1.

A Picture of the gooseneck microphone with speaker box from the company Tripo can be found in Figure 2-17.

**Figure 2-17: Gooseneck microphone with speaker box and PTT button**

More details of this audio equipment can be found at http://www.tipro.net/ecataloque/speakerbox/.

**Figure 2-18: Integrated audio equipment**

The handset with PTT button recommended in Chapter 2.3.2.3.2.1 and the gooseneck microphone with speaker box and PTT button recommended in Chapter 2.3.2.3.2.2 can be integrated physically, e.g. for saving place and space. A picture of this integrated audio equipment of dispatcher operation terminals can be found in Figure 2-18.

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### 2.3.3 Administration Client Terminals

As shown in Figure 2-5 administration client terminals of IFDS GSM-R dispatcher solution are connected to IFDS GSM-R central servers directly by TCP/IP. It is main task is to administrate IFDS GSM-R central server systems, including configuration management, fault and alarm management, security and subscriber management, performance tuning, software management and other OAM (operation, administration and maintenance) tasks.

The administration clients of IFDS GSM-R are also thin clients, providing only interfaces to system administrators. Their requirement to physical computing power and resources is limited. The administration and business logics and related data are processed directly at servers.

The administration client terminals of IFDS GSM-R are basically simple workstations or PCs. In principles, any normal desktops or laptops nowadays can be used as the hardware for the administration client terminals. No touch-screen capability is required.

## 2.4 Interfaces

Interfaces are used to connect different components and different systems to set up integrated solutions. They are the kernel part of seamless interoperation of different parts of the same solution, which are delivered by different vendors. The following chapters described the external interfaces used by IFDS GSM-R dispatcher solution of Siemens Convergence Creators to integrate with the other systems, especially the GSM-R infrastructure network, to build a common GSM-R communication solution for railway operations and the internal interfaces used within IFDS GSM-R solution to connect different solution-internal components.

### 2.4.1 External Interfaces

#### 2.4.1.1 Interfaces to GSM-R Infrastructure Network

As discussed before in Chapter 2.1.2 and shown in Figure 2-2, IFDS GSM-R solution of Siemens Convergence Creators requires 3 different interfaces to enable voice communication and text message communication based on SMS and to enhance railway operation intelligence.

##### 2.4.1.1.1 Voice Communication

ISDN-PRI on top of E1 interfaces is the only standardized interfaces specified by EIRENE and MORANE to enable voice communication between GSM-R mobile stations and fixed dispatcher operation terminals as well as among fixed dispatcher operation terminals over a GSM-R mobile communication infrastructure network. This interface is used by IFDS GSM-R dispatching solution to connect its central server system to the related MSC/MGW equipments of the GSM-R infrastructure network.

A physical E1 interface offers 30 bi-directional voice channels. Depending on customer demands and reliability requirements multiple E1 interfaces can be installed to provide and to ensure reliable voice communication capacity.

The E1 PRI ISDN (30B+D) interfaces used by IFDS GSM-R are compliant to

- ETSI ETS 300 125 (Layer 2),
- ETSI ETS 300 403 (ISDN Basic Call),
- ETSI ETS 300 286 (UUS),
- ETSI ETS 300 092-1 (CLIP),
- ETSI ETS 300 097-1 (COLP),
- ITU Q.955.3 (MLPP) and
- ETSI TS 102 610 (Usage of UUS for GSM-R).

##### 2.4.1.1.2 Text Communication

SMPP on top of IP is the only interface standardized by the SMPP Developers Forum for communication with SMS-Centers of the GSM-R mobile communication infrastructure network for sending and receiving text messages over SMS. As required by EIRENE, IFDS GSM-R dispatcher solution uses this interface to connect its central server system to the SMS-Centers of the GSM-R infrastructure network. Depends on


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reliability requirement, the SMPP interfaces between GSM-R dispatcher and the GSM-R infrastructure network can be duplicated.

Version 3.4 of SMPP is applied by IFDS GSM-R dispatcher solution of Siemens Convergence Creators.

#### 2.4.1.1.3 Enhanced Operation Intelligence

Though not clearly required in any EIRENE or MORANE standard specifications, some fundamental features enabling railway operation intelligence are widely required. For this purpose a proprietary interface based on IP-technology is optionally applied in IFDS GSM-R dispatcher solution to connect the dispatcher central server system to the related IN (intelligent network) functions of the NSS of the GSM-R infrastructure network. The basic functions of this interface include:

- Dynamic registration of dispatcher operation terminals to different operation roles into the GSM-R infrastructure network to enable dynamic LDA routing,
- Querying GSM-R mobile-stations (e.g. cab-radios, OPHs and GPHs) related dynamic location information to enable location related railway operation intelligence (e.g. dynamic train and mobile station lists) and
- Querying dynamic GSM-R mobile-stations (e.g. cab-radios, OPHs and GPHs) registrations to enable FN (function number) related special services.

The interface is designed based on MPL standardized by OMA and is required when premium operation terminals (Chapter 2.4.2.2) are to support.

MLP is an open protocol based on XML over HTTP for the implementation of GSM location based services. MLP describes the communication between an LCS Server, in this case the IN-function of the NSS of the GSM-R infrastructure network, and an LCS client, in this case the IFDS GSM-R dispatcher central server system. Both the LCS server and the LCS client need to be able to push and wait for data, i.e. both systems must implement HTTP client and server processes. HTTP Version 1.1 is applied.

Depends on reliability requirement, this interfaces between GSM-R dispatcher and the GSM-R infrastructure network can be duplicated.

### 2.4.1.2 Interfaces to Train Description Systems (TDS)

Cell-Id based location information of trains is usually not exact enough for most of the railway operations, as explained in EIRENE standards. To enable enhanced location-dependent operation services, like eLDA 2-stage solutions, dynamic train and mobile lists or location dependent SMS-services, IFDS GSM-R dispatcher needs interfaces to TDS to get dynamic information on the exact positions of trains, e.g. based on balises installed at rails. These optional interfaces are basically non-standard and IP-based.

### 2.4.1.3 Interfaces to Umbrella Network Managers

IP based SNMP version 3 interfaces are used to integrate IFDS GSM-R dispatcher solution into an external umbrella system for remote and centralized network management and maintenance.

### 2.4.1.4 Connection External Voice Recorders

All voice communications running over the dispatcher system, i.e. dispatcher-dispatcher voice calls, mobile-dispatcher voice calls and dispatcher-mobile voice calls are recorded locally by the central dispatcher server system. If required, IP-based interfaces can be provided to connect to external voice recording systems to share these records.

## 2.4.2 Internal Interfaces

### 2.4.2.1 Connecting Operation Terminals

Within the IFDS GSM-R dispatching solution, all the operation client terminals are connected to the central server system via IP-connections. Basically two kinds of data are transported over these IP-connections:

- Payload data for voice and text message communication and
- Control data for various operations.

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Operation client terminals connect always automatically to the active master server via its virtual IP-address, when redundancy is applied in the central server system.

#### 2.4.2.2 Connecting Administration Terminals

Administration client terminals are connected directly to IFDS servers by IP-connections.

#### 2.4.2.3 Enabling Redundancy

When redundancy is applied in the central server system of IFDS GSM-R dispatcher solution as described in Chapter 2.2, duplicated IP connections are used to connect the active master server and all the other passive slave servers. These IP-based internal interfaces are used

- For the active master server to update all the passive slave servers to keep them synchronized,
- For passive slave servers to
  - Monitor the heart-beat of the active server;
  - Take over the mastership by a newly elected master, when the old master fails to work properly.

# 3 Features

## 3.1 Basic GSM-R Services

### 3.1.1 Point-to-point Voice Call

Availability

This feature is available for both standard and premium operation terminals. Refer Table 2-2 for more details.

Summary

A P2P call is a call between a pair of any fixed or mobile equipment users (excluding specific data terminal equipment), where both call-parties can talk simultaneously.

This feature allows IFDS users to set up and to receive GSM-R point-to-point voice calls.
A P2P call set-up can be initiated by dial-pad, dial-wizard or via IFDS user/role-specific predefined or dynamic speed dial keys (e.g. phone-book or dynamic train-list).

### 3.1.2 Voice Group Call Services (VGCS)

Availability

This feature is available for both standard and premium operation terminals. Refer Table 2-2 for more details.

Summary

A VGCS is a call made to all members of a pre-defined group within a local geographical area. Only one member of the group may talk at a time with all other group members listening only.

This feature allows IFDS users to set up and to receive GSM-R group voice calls.

Muting or talking in a VGCS call on an IFDS terminal is supported by PTT handling using DTMF signaling as defined by EIRENE.

A VGCS call at an IFDS terminal can be released with or without termination of the voice group call.
Group call members are managed within NSS. IFDS administrator can predefine user or role specific CT5 service areas and CT5 group ids. An IFDS client terminal user can use this predefined group areas and ids to set up a voice group call.

During a group call the users are visually reminded that they have to use the PTT button for talking.


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### 3.1.3 Voice Broadcast Services (VBS)

Availability

This feature is available for both standard and premium operation terminals. Refer Table 2-2 for more details.

Summary

A voice broadcast call is a special group call made to all members of a pre-defined group within a local geographical area. Only the user who initiated the broadcast call may talk and all other group call members can only listen.

This feature allows IFDS users to set up and to receive GSM-R broadcast voice calls including PTT handling and call release with or without termination of the voice broadcast call.

Group call members are managed within NSS. IFDS administrator can predefine user or role specific CT5 service areas and CT5 group ids. An IFDS client terminal user can use these predefined group areas and ids to set up voice broadcast calls.

When an IFDS client terminal receives a broadcast call the user is visually informed that he cannot speak as a part of the broadcast call.

### 3.1.4 Conference Calls / Multi-party Calls

Availability

This feature is available for both standard and premium operation terminals. Refer Table 2-2 for more details.

Summary

A conference or multi-party call is a voice communication method whereby a number of parties defined by the call initiator may participate in the call. All parties may talk simultaneously.

This feature allows an IFDS user to create and manage a conference call.

Up to 30 conference members are supported. Conference members can be predefined by IFDS administrators, be assigned to certain users/roles or be managed ad-hoc by the IFDS terminal user himself.

The conference bridge is realized within the IFDS. It is an IFDS system option if the PTT handling should be used within conference calls.

### 3.1.5 Railway Emergency Calls (REC)

Availability

This feature is available for both standard and premium operation terminals. Refer Table 2-2 for more details.

Summary

A REC is a high priority voice group call for informing drivers, controllers and other concerned personnel of a level of danger requiring all Railway movements in a pre-defined area to stop.

An emergency call is initiated by pressing a dedicated emergency speed dial key on the IFDS terminal allowing the controller to react quickly and precisely to an emergency. The IFDS administrator can configure role specific predefined emergency targets.

A single click on the emergency key button of the IFDS terminal GUI, which is accessible from all menus, invokes the emergency page with all the pre-configured emergency targets.

Railway emergency calls are specially visualized (visually and acoustically) on the IFDS client terminal.

Incoming Railway emergency calls are put on first positions in the queue of all the incoming-calls and are

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automatically accepted after a predefined timeout. On the IFDS terminals the call-location of the REC initiator is shown if it is present in the User to User information of the SETUP message as standardized by ETSI TS 102 610 chapter 5.6.

Two types of Railway emergency calls are defined:

- Train emergency calls (for Railway emergencies whilst not involved in Shunting operations),
- Shunting emergency calls (for Railway emergencies whilst involved in Shunting operations).

### 3.1.6 Public Emergency Voice Calls (PEC)

Availability

This feature is available for both standard and premium operation terminals. Refer Table 2-2 for more details.

Summary

IFDS supports the public emergency call as specified in the EIRENE specifications. Public emergency call enables a dispatcher to contact local services for assistance in case of emergency.

A PEC is a point-to-point voice call which is used to notify non-railway authorities (such as police and ambulance services) of an emergency situation.

Public emergency calls use the eMLPP priority '2'.

A PEC is handled in a similar way as REC at IFDS GSM-R operation terminals.

The call is routed via the GSM-R network to the public emergency services.

### 3.1.7 High Priority Calls

Availability

This feature is available for both standard and premium operation terminals. Refer Table 2-2 for more details.

Summary

High priority calls (critical group calls for drivers in the same area initiated by a driver, critical group calls for station and security staff, trackside maintenance staff or controller groups) are made in exceptional circumstances where the situation requires a higher level of priority than for normal operational calls, but the same call handling regarding alerting and setup. These calls have lower priority than Railway and Public Emergency Calls.

High priority calls are basically voice group calls. But if required, point-to-point voice calls can be handled as high priority calls too. High priority calls use the eMLPP priority '2' – the same priority as PECs.

A high priority call can be started at an IFDS GSM-R operation terminal via speed buttons, dial-pad or dial-wizard.

### 3.1.8 Transmitting DTMF Tones

Availability

This feature is available for both standard and premium operation terminals. Refer Table 2-2 for more details.

Summary

This feature allows the IFDS terminal user to send DTMF tones during an call.


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## 3.2 Supplementary GSM-R Services

### 3.2.1 Call forwarding

Availability

This feature is available for both standard and premium operation terminals. Refer Table 2-2 for more details.

Summary

This supplementary service forwards incoming voice calls to another IFDS client terminal.

This feature allows to forward diverse voice calls to another IFDS dispatcher client terminal (for example during a short break). The forwarding remains active till it is deactivated on the terminal GUI that has activated the service. Only voice calls are forwarded (no SMS or other information).

### 3.2.2 Call Transfer

Availability

This feature is available for both standard and premium operation terminals. Refer Table 2-2 for more details.

Summary

Call transfer allows an IFDS user to pass an active call to another user different than the users participating in the call. After successful transfer the user will leave the call and the both calls are bridged.

This feature allows an IFDS user to transfer an active call to another user. Both duplex and semi-duplex calls can be transferred.

The transfer bridge is realized within the IFDS.

### 3.2.3 Calls On-Hold (Hold Queue)

Availability

This feature is available for both standard and premium operation terminals. Refer Table 2-2 for more details.

Summary

This feature allows ‘calls on-hold’ users to temporarily exit from an existing call. The user can re-join the call which is on hold at any time.

An IFDS operation terminal user has the possibility to hold an active voice call. IFDS feeds a hold-tone to the remote party. The call-hold feature is handled locally within IFDS, without using the ISDN supplementary service.

### 3.2.4 Call Waiting (Waiting Queue)

Availability

This feature is available for both standard and premium operation terminals. Refer Table 2-2 for more details.

Summary

‘Call Waiting’ informs IFDS users, who are involved in active calls, of attempts by other users to contact them.

This feature allows presentation and managing of the incoming call queue.

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All incoming calls or call requests are queued. The IFDS operation terminal GUI displays the queue to the users, showing the functional identities and priorities of callers. The IFDS terminal user can select any of the incoming calls currently queued.

Emergency calls should be identified and presented at the top of the queue followed by calls in order of their priorities. When a call is terminated, the next call (oldest) in the queue shall be indicated on the touch screen, unless there are higher priority calls in the queue. In that case the oldest of the highest priority calls shall be selected. The queue shall sort incoming calls in the chronological order they arrived.

Railway emergency calls shall be distinguished from other calls on the display and displayed at the top of the queue.

Depending on the call priority a system configurable timeout (once per priority value) would allow to auto-answer prioritized calls. A currently active call with a lower priority would be put on hold in this case.

### 3.2.5 Calling Line Identification Presentation (CLIP)

Availability

This feature is available for both standard and premium operation terminals. Refer Table 2-2 for more details.

Summary

This feature presents in the GUI the calling party identification, valid for both for individual and group communication.

This feature allows the IFDS terminal users to see the calling party identification of incoming individual and group calls. If available the FN is shown. If the FN isn't available the ISDN number received from the network is used for presentation. For Functional-Numbers a parsing and mapping to textual strings according to pre-defined tables is performed (e.g. Train 432 Chief conductor). The MSISDN number of the calling party isn't displayed for GSM-R calls if the functional number is available. For non-GSM-R calls, resolving the received number to symbolic names is performed, according to the pre-configured favorites and phonebook. If resolving of an FN or ISDN number isn't possible, the number is displayed as received from the network. The calling party information is shown in the call-queue, on the active call-buttons and within the call and SMS history.

For this feature the IFDS uses the ISDN supplementary service defined by ETSI ETS 300 092-1.

### 3.2.6 Connected Line Identification Presentation (COLP)

Availability

This feature is available for both standard and premium operation terminals. Refer Table 2-2 for more details.

Summary

For IFDS incoming calls this feature allows the calling user to see the IFDS target number that has accepted his call.

For this feature the IFDS uses the ISDN supplementary service defined by ETSI ETS 300 097-1.

## 3.3 Enhanced Features

### 3.3.1 Text Messages

Availability

This feature is available for both standard and premium operation terminals. Refer Table 2-2 for more details.

Summary


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Text message service is a service enabling transmission and receipt of point-to-point and point-to-multipoint text messages. Text message service does not interfere with the ability of users to make or receive calls with a higher priority.

This feature allows the IFDS terminal users to send and receive SMS messages. IFDS uses the IP based SMPP protocol to access the SMS service center.

### 3.3.2 SMS Text Templates

Availability

This feature is available for both standard and premium operation terminals. Refer Table 2-2 for more details.

Summary

This feature allows defining SMS templates for reuse. The visibility of SMS text templates is handled at different layers, e.g. global, role dependent or personal.

### 3.3.3 Enhanced Multi-level Priority and Pre-emption

Availability

This feature is available for both standard and premium operation terminals. Refer Table 2-2 for more details.

Summary

The service and the function of eMLPP deals with handling of call priorities.

This feature allows IFDS users to deal with different call priorities. It is based on the ISDN supplementary service standardized by ITU Q.955.3. Calls received from or sent to the GSM-R network have different priorities. ‘4’ is the lowest and ‘0’ the highest. A call with a higher priority terminates (pre-empts) a call with a lower priority, if all channels are already in use.

Calls received from external networks which do not support eMLPP will be assigned with the default eMLPP priority ‘4’.

The priority of incoming calls is indicated by different ring tones and visualizations. If the waiting queue is full, a further incoming call automatically pre-empts the longest waiting call with a lower priority.

For each priority 0-3 a timeout value within the IFDS can be configured to perform auto-answering of calls arriving with that priority.

### 3.3.4 Functional Addressing/Numbering

Availability

This feature is available for both standard and premium operation terminals. Refer Table 2-2 for more details.

Summary

FN is a term used to describe the process of addressing a call using a number representing the function a user is performing, instead of a number identifying the user’s terminal equipment.

A functional number is the full number used within the functional addressing scheme to contact an end-user/system by function or role rather than by a specific item of radio equipment or user subscription.

This feature allows IFDS users to deal with GSM-R functional numbers.

IFDS administrators can assign functional numbers to IFDS users and roles.

The FN identity is transmitted with the User to User Information element as defined in ETSI TS 102 610.

If available the functional number of the call peer is presented to the IFDS users.

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### 3.3.5 Background Calls

Availability

This feature is available for both standard and premium operation terminals. Refer Table 2-2 for more details.

Summary

This feature allows the IFDS terminal user to put one or more call(s) on a separate speaker for call monitoring. The IFDS user can listen but not talk to calls put on background.

### 3.3.6 Auto Answering

Availability

This feature is available for both standard and premium operation terminals. Refer Table 2-2 for more details.

Summary

Depending on call priorities, calls waiting in the incoming call queue may be automatically answered after a pre-configured timeout.

The default values of auto-answer timeout are:

- GSM-R priority 0: 10 seconds,
- GSM-R priority 1: 15 seconds ,
- GSM-R priority 2: 30 seconds ,
- GSM-R priority 3: -1 = infinite (no auto-answer) ,
- GSM-R priority 4: no auto-answer possible.

### 3.3.7 Alerting a Controller

Availability

This feature is available for both standard and premium operation terminals. Refer Table 2-2 for more details.

Summary

The feature “alerting a controller” allows any entitled talking or listening service subscriber to alert a specific controller or its terminal in order to ask that controller to join the ongoing group call or to listen to it.

According to EIRENE the IFDS supports the following procedure:

In case of ‘Alerting a Controller’ IFDS receives a p2p call with eMLPP priority 3 and an included UUS1 with the alerting tag. The alerting tag contains the group call reference the controller should contact. It is an IFDS system option whether the p2p call that contains an alerting-tag should be rejected or established. For the case that it should be released (established), the Release-Complete contains the UUS-1 information element with the alert-tag and FN of the controller. An indication shows the ‘alert’ request to the IFDS terminal user.

### 3.3.8 Instant Recording

Availability

This feature is available for both standard and premium operation terminals. Refer Table 2-2 for more details.

Summary


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This feature enables local recording and replaying voice communication between dispatching controllers or between dispatching controllers and train drivers as well as other GSM-R mobiles.

All voice recording via the IFDS is recorded inside IFDS for local replay on the IFDS terminals or for transmission to an overall GSM-R voice recording system. The local storage capacity is up to 30 days (depending on traffic volume).

### 3.3.9 Event Log

Availability

This feature is available for both standard and premium operation terminals. Refer Table 2-2 for more details.

Summary

This feature enables logging and showing of the all the related events taken place in this operation terminal.

The dispatcher terminal user interface provides a comprehensive view into the event history with following categorization of events:

- Incoming calls,
- Outgoing calls,
- Missed calls,
- Incoming SMS,
- Outgoing SMS.

The event log is user-specific.

Furthermore, IFDS operation terminals allow to call directly to a target stored in the event log.

### 3.3.10 Common Phonebook

Availability

This feature is available for both standard and premium operation terminals. Refer Table 2-2 for more details.

Summary

Subscribers, groups and dispatchers target numbers can be stored in a phonebook. Each item in the phonebook can be assigned to a call profile which specifies the call type and priority when being called. The phonebook is managed via the IFDS administration tool.

### 3.3.11 Speed-Dial-Buttons (Favorites)

Availability

This feature is available for both standard and premium operation terminals. Refer Table 2-2 for more details.

Summary

This feature allows creation of soft keys of direct access enabling one-click calls managed by the IFDS terminal user.

### 3.3.12 IFDS Server Redundancy

Availability

This feature is available for both standard and premium operation terminals. Refer Table 2-2 for more details.

Summary

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This feature provides the reliability design such the active/standby mode, heartbeat, synchronization, switchover and redundancy configuration, thus improving the system reliability.

The IFDS system design is fully redundant, with no single point of failure. Duplicated servers, duplicated interfaces and a duplicated power supply are used. If a component fails, the system will initiate an automatic switchover of the failed component.

The IFDS central switch uses a IFDS master / (multi)slave server replication with dedicated heartbeat and high availability management. The heartbeat / high availability service controls which IFDS slave server shall be promoted to master in case of failover scenario.

Duplicated (redundant) IP connectivity between all involved IFDS servers are used.

Refer to Chapter 2.2 for more details.

### 3.3.13 Subscriber Management

Availability

This feature is available for both standard and premium operation terminals. Refer Table 2-2 for more details.

Summary

This feature offers IFDS user identity verification and ensures that only authorized users can use IFDS terminals, thereby guarantying the security of their usage.

The IFDS subscriber-profile contains logon (username, password), personal settings (e.g. favorites) and access-right information's (e.g. terminals and roles the user is allowed to use). It contains also the DDI (Direct Dial In)-number, with which the user is personally reachable by other dispatchers or PABX subscribers. Optionally a personal FN can be configured via that the user can be reached directly, independent of his current role.

Further parameters of an IFDS role include:

- user specific phone book entries,
- favorites,
- user-specific personal settings for e.g. language, ringtones etc.

### 3.3.14 Role Management

Availability

This feature is available for both standard and premium operation terminals. Refer Table 2-2 for more details.

Summary

This feature allows an IFDS user to operate e.g. as a primary controller, a secondary controller or a traffic controller.

The IFDS administration allows defining IFDS roles that can be associated with a GSM-R functional number. Parameters of an IFDS role include:

- the MSISDN DDI (Direct Dial In)-number via the role is reachable by subscribers,
- role specific phone book entries,
- role specific SMS text templates etc.

Usage of IFDS roles can be restricted to certain IFDS users or terminals.

IFDS roles can be administrated that they may or may not be shared simultaneously by different IFDS users:

- sole roles: This roles cannot be shared by users. If an user attach to this role, the currently user is detached automatically (e.g. for shift changes);


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- shared roles: Attach of multiple users to this role is possible. Incoming calls and SMS are distributed to all attached users. For P2P calls the first answering user gets the call.

### 3.3.15 Administration Clients

A dispatcher administration client terminal is a workstation system or a laptop with administration software package for configuration and maintenance of the IFDS. Refer Chapter 2.3.3 for more details.

### 3.3.16 Shunting Mode

Availability

This feature is available for both standard and premium operation terminals. Refer Table 2-2 for more details.

Summary

This feature allows operating an IFDS terminal in shunting mode which will regulate and control user access to shunting communications.

This feature realizes an optional EIRENE requirement (see EIRENE SRS Chapter 8.4).

It allows the IFDS user to login with a specific role for 'shunting'. During operation with a role for shunting the following apply:

- Group calls with group id 2xx (incl. 299) are not handled.
- Group calls for shunting (group id 5xx) must be handled.
- The emergency button is assigned to group id 599.
- A Railway shunting emergency call is used to instruct shunting teams to cease shunting movements immediately.
- Shunting calls are using 'Railway operation' priority.
- It is an IFDS system option if the PTT button must be used for P2P calls in shunting mode (refer to EIRENE SRS 14.7.29, 14.7.30).

The activation of this feature is an IFDS system option.

### 3.3.17 Dynamic Train and Mobile list

Availability

This feature is available only for the premium operation terminals. Refer Table 2-2 for more details.

Summary

This feature allows showing the IFDS users/roles the dynamic list of trains/mobiles existing/moving currently in the areas of his control responsibility.

The availability of this feature is GSM-R infrastructure dependant. It requires the presence of a proprietary interface to the IN system of the NSS. Refer to Chapter 2.4.1.1.3 for more details.

Mobile location information (FN, cell-id, etc.) is periodically delivered from GSM-R NSS and presented to the relevant IFDS users. The IFDS users can see a list of registered-entities (trains, engines) currently existing/moving in his areas of responsibility (GSM cell or list of cells) and can use this list to quickly communicate (call, SMS) with these entities.

### 3.3.18 Enhanced Location-dependent Addressing (eLDA)

Availability

This feature is available for both standard and premium operation terminals. Refer Table 2-2 for more details.

Summary

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Accuracy of cell dependent addressing is sometimes not sufficient for all operational scenarios. Several railways have therefore indicated that an enhanced system is required. To provide a greater degree of accuracy, additional information from (external) location information sources is necessary.

The called party address of an eLDA call is exclusively to be determined by the dialed Short Dialing Code (SDC), representing a particular function-role, and the location of the calling party at the time of calling. eLDA is applicable only to mobile originated point to point voice and data calls initiated by a EIRENE mobile station that provides eLDA location information as specified in the MORANE IRS on eLDA. eLDA is not applicable to, e.g. railway emergency calls; group- and broadcast calls; GPRS calls; SMS message transfer.

The eLDA function shall use cell dependent routing as a fall-back mechanism in case of failure or non-coverage of eLDA.

IFDS is currently designed to operate with the 'Single Stage eLDA Call Routing' solution recommended by the MORANE eLDA Interface Requirement Specification.


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# 4 Abbreviations and Acronyms

| | |
|---|---|
| BSC | Base Station Controller |
| BTS | Base Transceiver Station |
| CLIP | Calling Line Identification Presentation |
| COLP | Connected Line Identification Presentation |
| CT | Call Type |
| DDI | Direct Dial In |
| EIRENE | European Integrated Railway Radio Enhanced Network |
| eLDA | enhanced LDA |
| eMLPP | enhanced Multi-level priority preemption |
| FN | Functional Number |
| FRS | Function Requirement Specification |
| GSM | Global System for Mobile Communication |
| GSM-R | GSM for Railways |
| HW | Hardware |
| HLR | Home Location Register |
| IFDS | Integrated Fixed Dispatching System |
| IRS | Interface Requirement Specification |
| IP | Internet Protocol |
| ISDN | Integrated Services Digital Network |
| LDA | Location Dependent Addressing |
| MGW | Media Gateway |
| MLP | Mobile Location Protocol |
| MLPP | Multi-Level Precedence and Preemption |
| MORANE | Mobile Radio for Railways Networks in Europe |
| MSC | Mobile Switching Centre |
| NSS | Network Subsystem |
| OMA | Open Mobile Alliance |
| PABX | Private Automatic Branch Exchange |
| PBX | Private Branch Exchange |
| PEC | Public emergency call |
| PLMN | Public Land Mobile Network |
| PRI | Primary Rate Interface |
| PSTN | Public Switched Telephone Network |
| PTT | Push To Talk |
| P2P | Point-to-point |

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| | |
|---|---|
| REC | Railway Emergency Call |
| SDC | Short Dialing Code |
| SIM | Subscriber Identity Module |
| SMPP | Short Message Peer to Peer |
| SMS | Short Message Service |
| SMSC | SMS Center |
| SNMP | Simple Network Management Protocol |
| SRS | System Requirement Specification |
| TDS | Train Description System |
| UUS1 | User to User Signal 1 |
| VBS | Voice Broadcast Service |
| VGCS | Voice Group Call Service |
| VLAN | Virtual LAN |
| VLR | Visitor Location Register |
| VMS | Voice Mail Service |
| VRS | Voice Recording System |
| WLAN | Wireless Local Area Network |


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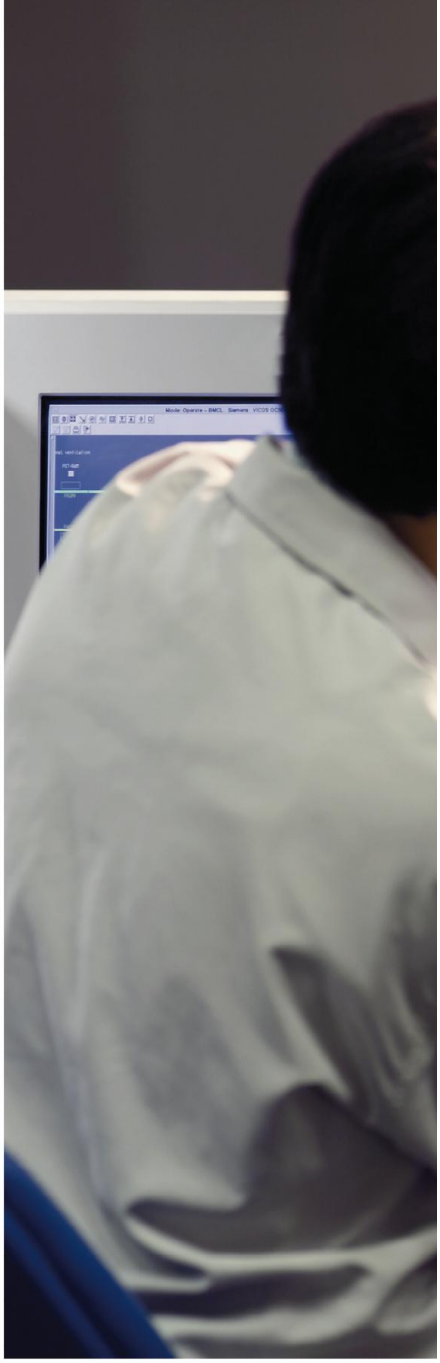

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# 3 MOBILE ACCESS ROUTER (MAR)



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# MH70S

## Rugged 4U, 40 HP Modular Storage System

# User Manual

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# MH70S – Built-to-Order Rugged 4U, 40 HP Modular Storage System

## Modular, Built-to-Order Configuration

The MH70S is a modular turn-key storage PC which meets the requirements of storage intensive applications such as digital video recorders, content servers or NAS. It is designed for use in trains, trams or industrial environments.

The system consists of a modular 40 HP CompactPCI Serial system which can be wall or rack-mounted. The system can be cooled by natural convection or using an additional fan tray at the bottom of the system. Cooling is independent of the mounting position.

The PC offers a multitude of configuration possibilities which are built to order resulting in a fast time-to-market. The system comes with complete software support.

## Storage, Ethernet Switch and Wireless Functionality

Thanks to its up to five HDD/SSD carriers (2 HDDs each), the MH70S forms a high performance and high capacity storage system. Up to eight PoE PSE ports supplying eight devices with a maximum of 100 Watts in total can be implemented. For robust and safe operation, the HDD carriers can be configured in RAID 0, 1 or 5 while the carriers themselves have their own internal RAID 0, 1 and JBOD hardware configuration possibility.

The system offers up to 2 Gigabit Ethernet interfaces at the front of the CPU board. PCI Express Mini cards for wireless functions such as WLAN and UMTS can also be provided.

## High-Performance Processor and System Control

The system is based on a high-performance Intel Core i7 processor supporting Intel AMT functionality. Data security can be assured using a TPM module. A shelf controller complements the self-control and self-monitoring capabilities. It manages life-time information about i.e. the shelf fans, power supplies and can be used for manual shutdown.

## Redundant Power Supply

The pre-configured system offers two PSU slots to ensure reliability and redundancy. Normal operation is guaranteed if at least one external voltage is present. AC or DC power supplies can be implemented. Each power supply has its own power source. This allows the switch to be fed from independent power distribution networks assuring failover functionality and power-cut bridging.



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# Technical Data

## General System Characteristics

- Modular design, built-to-order configuration
- Slot and backplane set-up of the system
  - 2 PSU slots
  - 1 CompactPCI Serial system slot
  - 6 CompactPCI Serial peripheral slots

Choose the functionality you need using the BTO configurator and the BTO Configuration Guide.
Please contact MEN if you need more information.

## CPU Board

- CPCI Serial 3U Board
- Configurable: yes
- Possible Configurations:
  - Intel Celeron 2002E 1.5 GHz, 4 GB DDR3 DRAM with ECC, front: 2 DisplayPort, 2 USB, 2 Gb Ethernet (RJ45), -40 to +85°C screened
  - Intel Core i7-4700EQ 2.4 GHz, 16 GB DDR3 DRAM with ECC, front: 2 DisplayPort, 2 USB, 2 Gb Ethernet (RJ45), 0 to +60°C
- Mass Storage
  - SSD mSATA, 8 GB, -40 to +85°C or
  - SSD mSATA, 32GB, 0..+70°C

## Supervision and Control

- Dedicated shelf controller monitors power, CPU status, temperature; controls fan; provides status LEDs and power button
  - More information on AF2 Shelf Controller for CompactPCI and CompactPCI Serial Systems

## Power Supply

- PSU 3U
- Configurable: yes
- Possible Configurations:
  - 120 W, 3U 6 HP PSU, wide range input 24 to 110 V DC, 24 V DC nom., output 12 V / 5 V / 3.3 V DC, -40..+85°C, qualified, conformal coating
  - 120 W, 3U 6 HP PSU, wide range input 100 to 240 V AC, output 12 V / 5 V / 3.3 V DC, -40..+85°C, qualified, conformal coating
- Two separate power inlet connectors
- Normal operation if at least one external voltage is present



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## Wireless Functionality via PCI Express Mini Cards

- CPCI Serial 3U Board
- Configurable: yes
- Possible in CompactPCI Serial peripheral slot: 1, 2
- 2 PCI Express® Mini Card slots (USB and PCIe®), -40..+85°C screened
- Possible Configurations
  - WLAN PCI Express® MiniCard DNXA-116, -40 to +85°C screened
  - MC7304 PCI Express® MiniCard, full-size on USB: LTE, DC-HSPA+, HSPA+, HSDPA, HSUPA, WCDMA, GSM, GPRS, EDGE, and GNSS, -40 to +85°C

## Ethernet Interface Functionality

- CPCI Serial 3U Board
- Configurable: yes
- Possible in CompactPCI Serial peripheral slot: 1
- Possible Configurations
  - 4 1000Base-T Ethernet interfaces, 4 RJ45 connectors at front, 0..+60°C
  - 4 1000Base-T Ethernet interfaces, 4 M12 connectors at front, -40..+85°C screened, conformal coating

## Ethernet Switch Functionality

- CPCI Serial 3U Board
- Configurable: yes
- Possible in CompactPCI Serial peripheral slot: 1, 2
- Possible Configurations
  - 4-port unmanaged Gigabit Ethernet Switch with PoE, RJ45, -40..+70(+85)°C with qualified components
  - 4-port unmanaged Gigabit Ethernet Switch with PoE, M12, -40..+70(+85)°C with qualified components, conformal coating

## Mass Storage

- CPCI Serial 3U Board
- Configurable: yes
- Possible in CompactPCI Serial peripheral slot: 2, 3, 4, 5, 6
- Possible Configurations
  - Two 2.5" SATA HDD/SSD shuttle, hot swap, RAID 0, 1 JBOD support, -40..+85°C with qualified components, conformal coating

## Mechanical Specifications

- Dimensions:
  - 210 x 175 x 225 mm max. without brackets
  - 4U, 40HP
- Mounting Possibilities
  - Wall-mount
  - Rack-mount in 19" cabinet
  - Two systems side-by-side to build a single 19" chassis



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## Environmental Specifications

- Temperature range (operation): EN 50155 class TX depending on configuration
  - 0 °C to +50°C for high performance passenger information / video distribution systems with PoE and fans
- Temperature range (storage): -40..+85°C
- Cooling concept
  - Air-cooled, forced convection with fan tray at system bottom
- Relative humidity (operation): according to EN 60068-2-30, non-condensing
- Relative humidity (storage): according to EN 60068-2-30
- Altitude: -300 m to +3000 m
- Shock: according to EN 61373 category 1 class B
- Vibration: according to EN 61373 category 1 class B
- International Protection Rating (IEC 60529): IP20

## EMC Conformity

- EN 55022 class B (radiated and conducted emissions)
- EN 55024 (immunity)

## Safety

- Electrical Safety
  - EN 60950-1, class I equipment
- Flammability
  - UL 94V-0

## Supported Software

- Linux
  - Ubuntu with current LTIB kernel
- OpenMediaVault for Network Attached Storage
- Windows (on request)



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# Product Safety

## Electrostatic Discharge (ESD)

Computer boards and components contain electrostatic sensitive devices. Electrostatic discharge (ESD) can damage components. To protect the board and other components against damage from static electricity, you should follow some precautions whenever you work on your computer.

- Power down and unplug your computer system when working on the inside.
- Hold components by the edges and try not to touch the IC chips, leads, or circuitry.
- Use a grounded wrist strap before handling computer components.
- Place components on a grounded antistatic pad or on the bag that came with the component whenever the components are separated from the system.
- Only store the board in its original ESD-protected packaging. Retain the original packaging in case you need to return the board to MEN for repair.



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# About this Document

This user manual is intended only for system developers and integrators, it is not intended for end users.

It gives an overview of the system and describes possible functions. For a detailed description of the functionality of the individual boards please refer to the boards' user manuals.

MH70S product page with up-to-date information and downloads:
www.men.de/products/mh70s/

## History

| Issue | Comments | Date |
|---|---|---|
| E1 | First issue | 2015-12-11 |



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## Conventions

Indicates important information or warnings concerning situations which could result in personal injury, or damage or destruction of the component.

Indicates important information or warnings concerning the use of voltages that could lead to a hazardous situation which could result in personal injury, or damage or destruction of the component.

Indicates important information concerning electrostatic discharge which could result in damage or destruction of the component.

Indicates important information or warnings concerning proper functionality of the product described in this document.

The globe icon indicates a hyperlink that links directly to the Internet. When no globe icon is present, the hyperlink links to specific information within this document.

| | |
|---|---|
| *Italics* | Folder, file and function names are printed in *italics*. |
| Mono | A `monospaced` font type is used for hexadecimal numbers, listings, C function descriptions or wherever appropriate. Hexadecimal numbers are preceded by "0x". |
| *Comment* | Comments embedded into coding examples are shown in green text. |
| IRQ#<br>/IRQ | Signal names followed by a hashtag "#" or preceded by a forward slash "/" indicate that this signal is either active low or that it becomes active at a falling edge. |
| In/Out | Signal directions in signal mnemonics tables generally refer to the corresponding board or component, "in" meaning "to the board or component", "out" meaning "from the board or component". |



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## Conformity

MEN products are no ready-made products for end users. They are tested according to the standards given in the Technical Data and thus enable you to achieve certification of the product according to the standards applicable in your field of application.

## RoHS

Since July 1, 2006 all MEN standard products comply with RoHS legislation.

Since January 2005 the SMD and manual soldering processes at MEN have already been completely lead-free. Between June 2004 and June 30, 2006 MEN's selected component suppliers have changed delivery to RoHS-compliant parts. During this period any change and status was traceable through the MEN ERP system and the boards gradually became RoHS-compliant.

## WEEE Application

The WEEE directive does not apply to fixed industrial plants and tools. The compliance is the responsibility of the company which puts the product on the market, as defined in the directive; components and sub-assemblies are not subject to product compliance.
In other words: Since MEN does not deliver ready-made products to end users, the WEEE directive is not applicable for MEN. Users are nevertheless recommended to properly recycle all electronic boards which have passed their life cycle.

Nevertheless, MEN is registered as a manufacturer in Germany. The registration number can be provided on request.

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# 1 Product Description

## 1.1 Housing

The MH70S housing has the following main characteristics:

- Height: 4U
- Width: 40 HP
- Depth: 224.5 mm
- EMC shielded

Two MH70S systems can be installed side-by-side to fit into a standard 19" system. It is also possible to combine the MH70S with a different system of the same form factor in this way.

See Chapter 2.3 Mounting the MH70S on page 18 for more information.

## 1.2 Possible Applications and Configurations

The MH70S is a build-to-order system which is delivered fully operational with the OpenMediaVault or Linux operating system including all necessary drivers.

It consists of the basic system including backplane and mounting rails and provides:

- 2 slots for PSU
- 1 CompactPCI Serial slot for the CPU board
- 6 CompactPCI Serial peripheral slots for Ethernet switch and mass storage functionality

- Chapter 3 Functional Description on page 28 lists all components that can be implemented in the system.
- Choose the functionality you need using the BTO configurator and the BTO Configuration Guide.
- Contact MEN for more information.

This chapter gives some typical configuration examples of the MH70S. As the product concept is very flexible, other configurations are also possible.



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### 1.2.1 Application Example: NAS

The MH70S can be used as a media server, a video recorder or as an NAS system.

The system can be ordered with the open source OpenMediaVault operating system pre-installed.

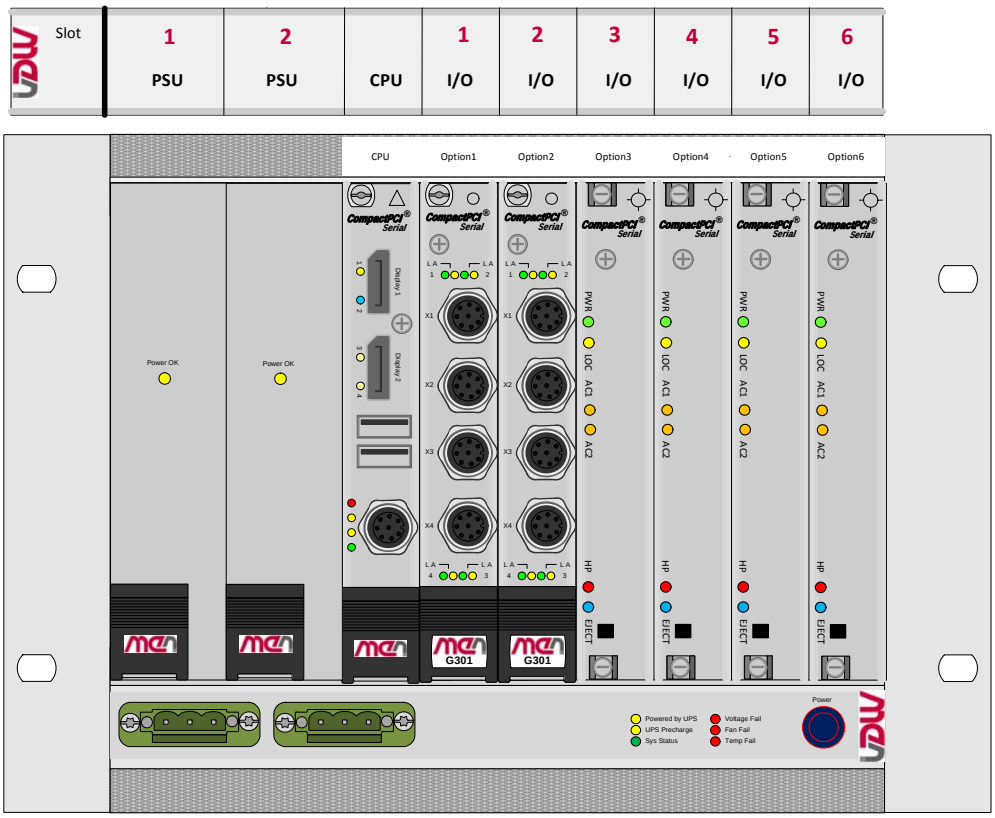
The operating system OpenMediaVault is based on the Linux distribution Debian and offers a complete and user-friendly NAS and RAID management as well as monitoring via SNMP, diagnosis interfaces and remote functions like Samba/NFS, FTP or iSCSI.

### 1.2.2 Configuration Example: Maximum Configuration

The configuration example illustrates a configuration including:

- Eight PoE PSE ports supplying eight devices with a maximum of 100 Watts in total
- Four dual HDD carriers with 2 HDDs/SSDs each. Configured as one drive a capacity of about 16 TB (with 2 TB 2.5" HDDs installed) can be achieved.

*Figure 1. MH70S configuration example: maximum configuration*



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## 1.3 Cooling Concept

Cooling of the MH70S depends on its total power consumption:

- Natural convection for fanless operation
  - Possible with some of the CPUs available
- Forced convection using two fans in a fan tray at the bottom of the housing
  - Generally required if the system bottom and top are covered
  - Required with some of the CPUs available

> When the system is cooled using fans the perforations at the front of the system have to be open to enable the required airflow of 1.5 m/s for cooling the system.

Depending on the mounting situation, there are two possible ways for the air to flow through the housing:

*Figure 2. Bottom and top of system **not covered**: airflow from bottom to top*

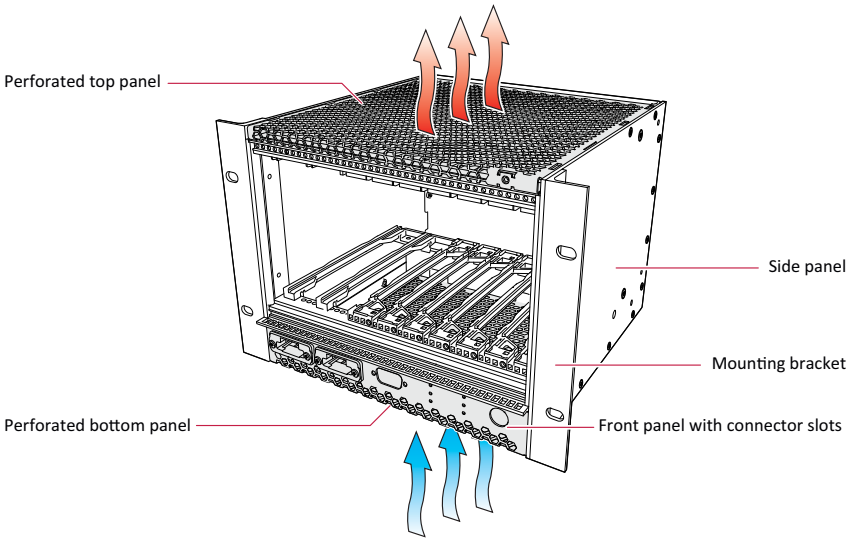




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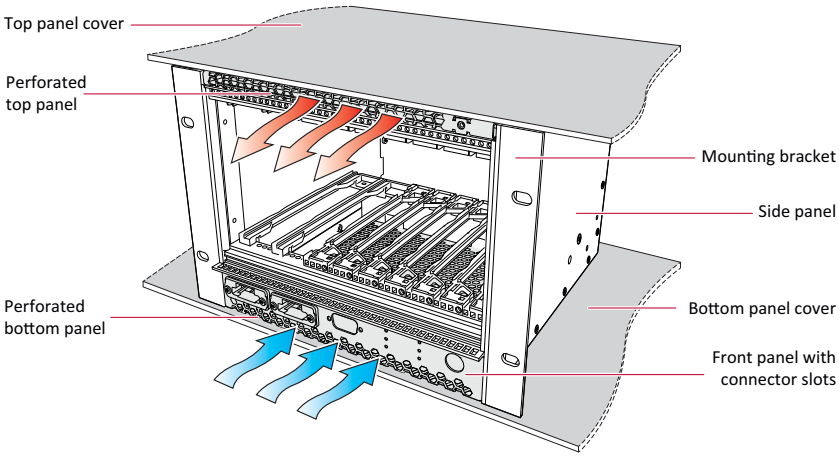
*Figure 3. Bottom and top of system **covered**: airflow from front bottom to front top*




## 1.4 Product Identification

MEN user documentation may describe several different models and/or design revisions of the MH70S. You can find information on the article number, the design revision and the serial number on a label affixed to the chassis.

- **Article number:** Indicates the product family and model. To be complete it must have 9 characters.
- **Revision number:** Indicates the design revision of the product.
- **Serial number:** Unique identification assigned during production.
- **Ordering key:** Unique ordering number of a built-to-order (BTO) configuration.

If you need support, you should communicate these numbers to MEN.

*Figure 4. Product label (BTO model)*

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# 2 Getting Started

## 2.1 Unpacking the System

After unpacking, check whether there are any transport or other damages on the system. If one of the following situations arises, have the equipment checked by service personnel:

- The power cable or plug is damaged.
- Liquid has penetrated into the equipment.
- The equipment has been exposed to moisture.
- The equipment does not work well, or you cannot get it to work according to the user manual.
- The equipment has been dropped and damaged.
- The equipment has obvious signs of breakage.

***Electric shock and fire hazard due to damaged device***

Damaged equipment may be under dangerous voltage and can cause fire. Damaged equipment has unpredictable behavior and characteristics.

- Prevent that damaged equipment is installed and put into operation.
- Mark the damaged equipment and keep it under lock and key.
- Send the equipment to repair immediately.

***Damage from condensation***

When the equipment has been subjected to low temperatures or extreme temperature variations, condensation can form on or inside the system. Humidity causes short circuits in electric circuits and damages the system. To avoid damages, do the following:

- Store the equipment in a dry environment.
- Ensure that the equipment has the same temperature as the environment before starting it up.
- Do not subject the equipment to the direct radiation of a heating device.
- Wait until the equipment has dried completely or wait 12 hours before switching on the equipment.

## 2.2 Scope of Delivery

The delivery includes the following accessories:

- Two mating connectors for the power supply (Phoenix)
- Material for coding the mating connectors ("coding star")
- Four M4x12 countersink head screws coated with securing material for installing the mounting brackets at the rear of the system.

See Chapter 2.3.2 Wall-Mounting the MH70S on page 18.



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## 2.3 Mounting the MH70S

The MH70S is delivered with two mounting brackets. They can be installed at the front of the housing for installing it in a 19" rack or at the back of the system for wall-mounting.

- See Chapter 2.3.2 Wall-Mounting the MH70S for information on how to wall-mount the MH70S.
- See Chapter 2.3.3 Mounting the MH70S in a 19" Rack for information on how to install the MH70S in a 19" system.

### 2.3.1 Safety Instructions for Mounting

***Risk of damages or injuries***

- Make sure that the cabinet or the wall where you want to install the system supports the weight of the system.
- Do not put the system on top of other equipment. When the system drops it can cause damages and injuries.

***Risk of fire through overheating***

Make sure that the equipment does not overheat. Overheating can cause fire or malfunction of the device. Conformity to standards expires.

- Mount the equipment only in the mounting position described in this document and adhere to the environmental conditions specified in the Technical Data.
- Leave enough space above and below the system to enable the required airflow.
- Do not cover openings which are required for the airflow.
- Make sure that all unused slots are covered by cover plates to prevent the cooling air from escaping through open slots.
- Do not install the system near any heat sources (e.g., radiators, heat registers).

***Risk of damage to the system***

- Keep the system away from liquids. Avoid exposure to dripping or splashing.

### 2.3.2 Wall-Mounting the MH70S

The MH70S systems may be delivered with the mounting brackets installed at the front of the system. To mount the MH70S on a wall, the mounting brackets have to be moved to the rear of the system.

Carry out the following steps to move the brackets to the rear of the system:



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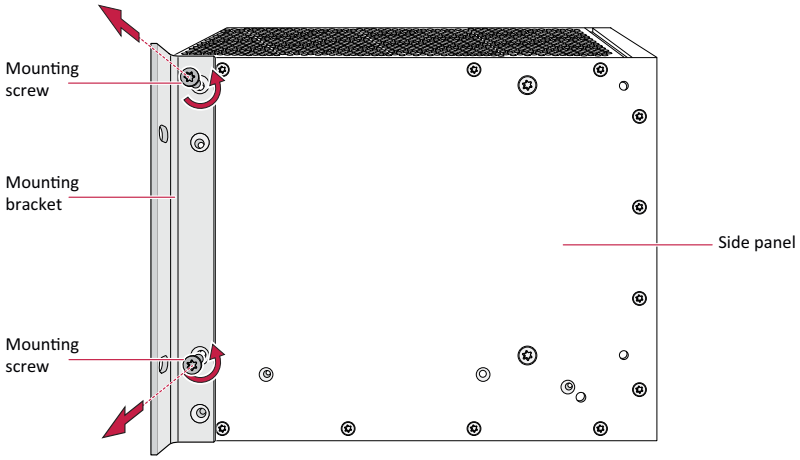
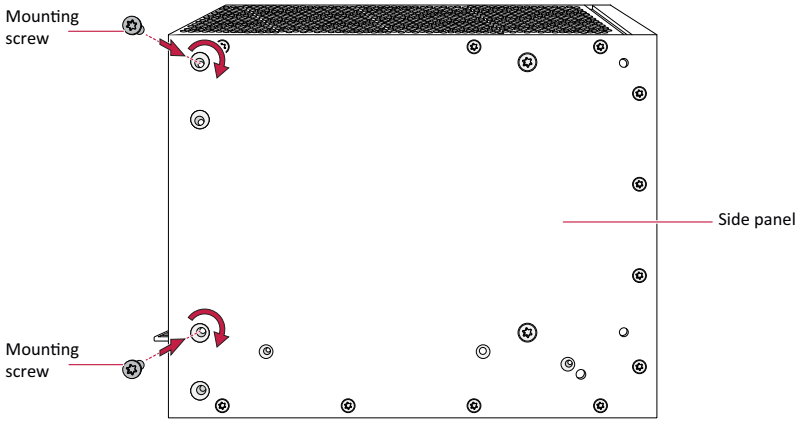
» To remove the mounting bracket, loosen the two screws securing the mounting bracket:




» After removing the mounting bracket, replace the two screws previously removed to their former position to ensure the stability of the system:



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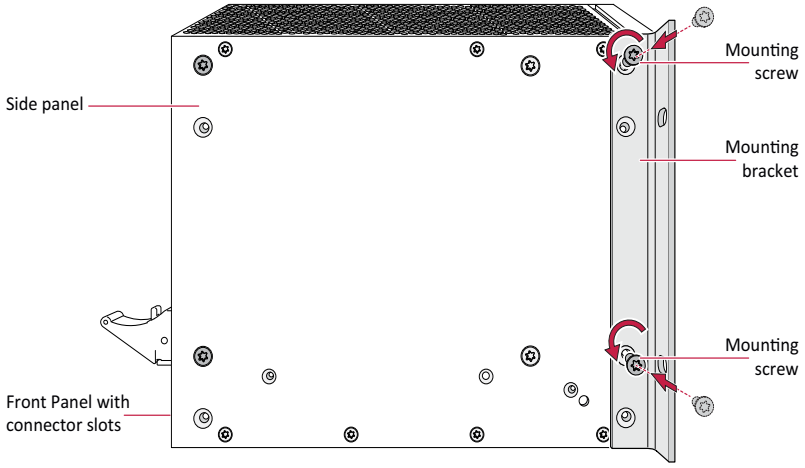
» Attach the mounting bracket to the back of the system, and secure it with the M4x12 TX20 countersink head screws included in the delivery (two for each side).




» Repeat the above process for the mounting bracket on the other side of the system.



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### 2.3.3 Mounting the MH70S in a 19" Rack

#### 2.3.3.1 Installing Two MH70S Systems Side-by-Side in a 19" Rack

A bonding kit, which is available from MEN, is needed for installing two MH70S systems side-by-side in a 19" rack.

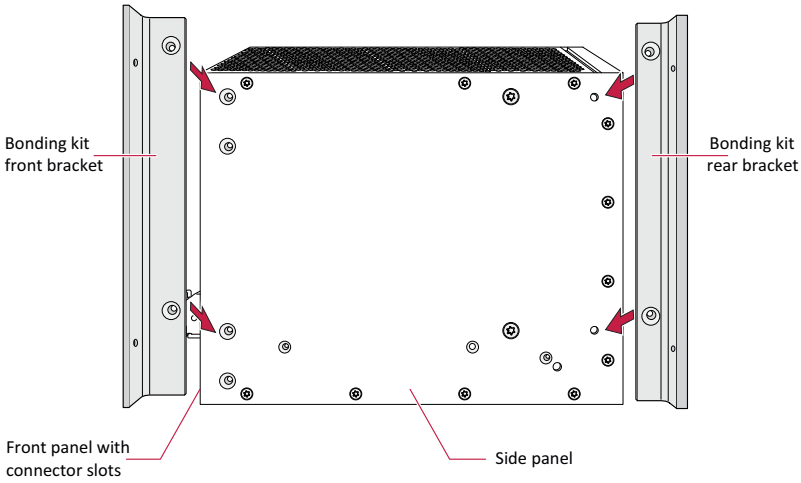
See the MEN website for ordering information.

The bonding kit includes a front bracket and a rear bracket. Carry out the following steps to install the brackets:

» Remove the mounting bracket at the right side of one MH70S and on the left side of the other MH70S.

See Chapter 2.3.2 Wall-Mounting the MH70S on page 18.

» Place the front and rear brackets supplied with the bonding kit as shown in the following illustration:




» Secure the left bonding kit bracket using the two M4x12 TX20 countersink head screws previously removed.



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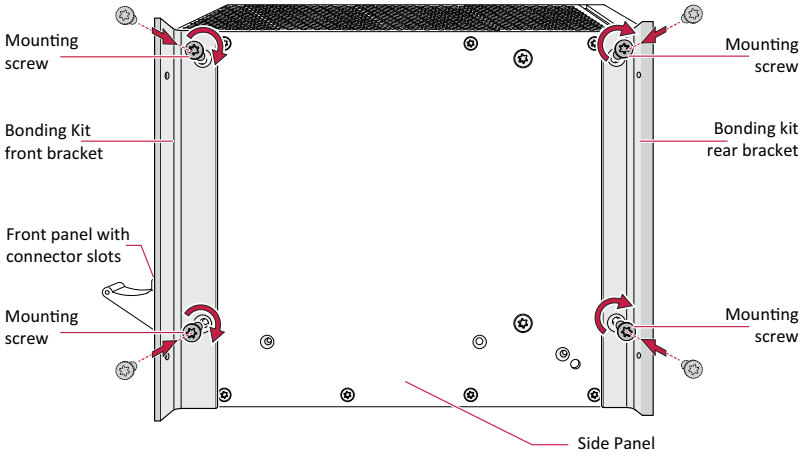
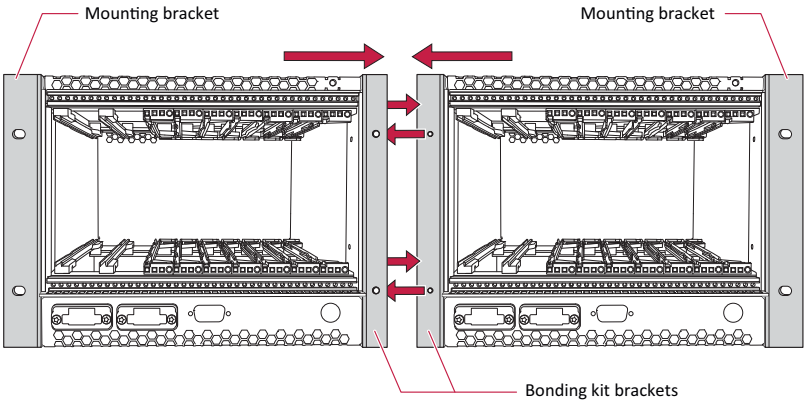
» Secure the right bonding kit bracket using two of the M4x12 TX20 screws delivered with the MH70S.




» Place the two MH70S systems next to each other and slide them together so that the screw holes in the bonding kit brackets are aligned, as in the following picture:



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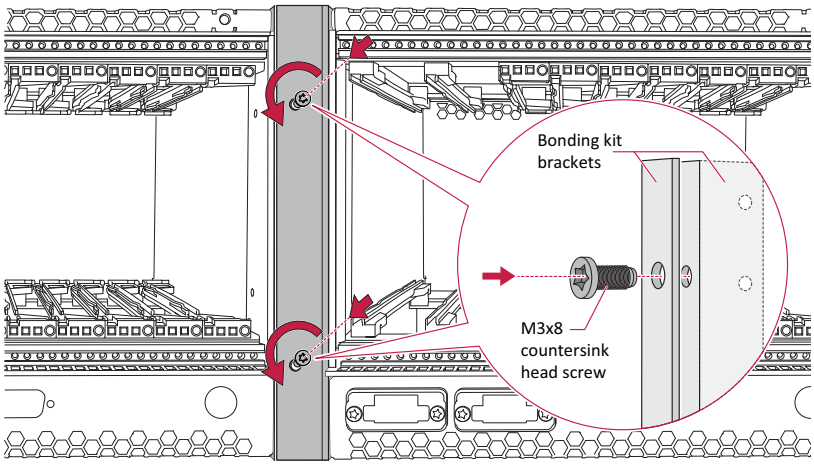
» Connect the systems using four M3x8 countersink head screws (two screws at the front and two at the back).



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### 2.3.3.2 Installing One MH70S in a 19" Rack

A mounting kit, available from MEN, is needed to install one MH70S system in a 19" rack. The kit is always installed on the right side of the system.

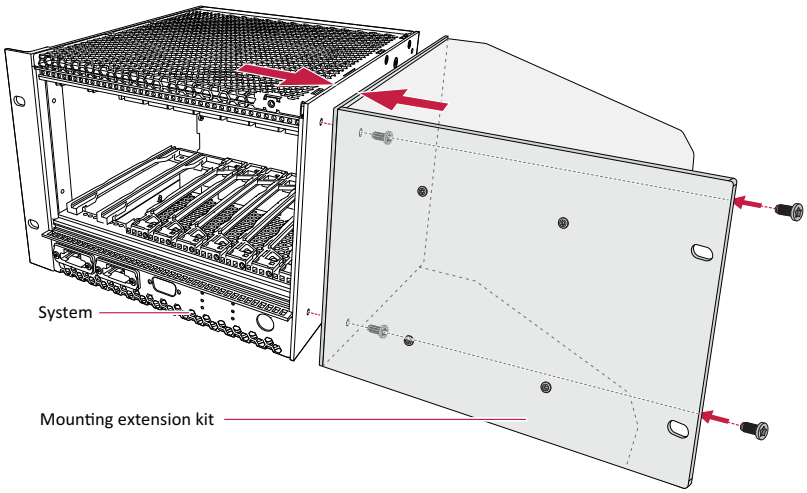
See the MEN website for ordering information.

Carry out the following steps to install the mounting kit:

» Remove the mounting bracket at the right side of the MH70S.

See Chapter 4.4 Exchanging Plug-In Boards on page 40.

» Screw the kit to the right side of the MH70S using the four M4x12 screws removed before (highlighted in red).



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## 2.4 Connecting the System

### 2.4.1 Safety Instructions for Connection

Follow the safety instructions before you connect the MH70S. Read all labels and warnings on the equipment carefully; especially the power configuration and coding label affixed to the system chassis.

- Works on the computer system may only be carried out by personnel qualified for the specific task, who, based on their training and experience, are able to identify risks and avoid potential hazards when working with these products/systems.
- The power inputs for the PSUs have to be protected using fuses with a maximum current of 16 A for each PSU.
- Implement a readily accessible disconnect device external to the system for complying with the EN 60950-1 standard.
- Make sure that the voltage supplied by the external power supply conforms with the voltage given on the power configuration and coding label.
- Adhere to the wiring rules valid in your country when connecting the system.

### 2.4.2 Connecting an Earthing Cable

The MH70S features an earthing connection.

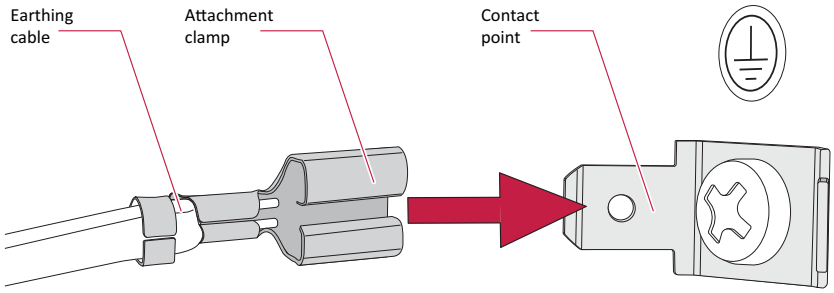
- Connect the earthing cable before making any other connections! A protective earth connection is essential for the system to meet its EMC specifications.
- When disassembling the system, always detach the earthing cable last.

Carry out the following steps to connect the earthing cable:

» Use an earthing cable with a cross section of at least 0.75 $mm^2$.

» Fasten the cable at the contact point of the earthing connection using a suitable attachment clamp, as indicated in the following illustration.

*Figure 5. Earthing connection*



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### 2.4.3 Connecting Peripherals

Connect the following peripherals:

» Connect a USB keyboard and mouse to the USB connectors at the front panel.

» Connect a flat-panel display capable of displaying the resolution of 1024x786 to a DisplayPort connector at the front panel of the MH70S.

» Connect all other peripherals needed for your system function.

### 2.4.4 Connecting the Power Supply

Make sure that an earthing cable has been connected to the system before connecting an external power supply and switching on the system.

Depending on the PSU card configuration of the MH70S, you can connect the following external power supplies:

- One DC power supply
- One AC power supply
- Two DC power supplies
- Two AC power supplies
- One DC power supply and one AC power supply

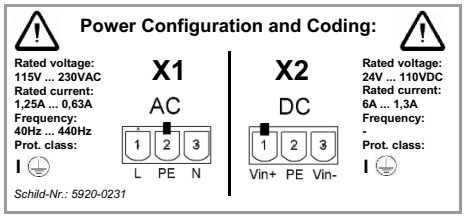
Power is supplied using 3-pin COMBICON connectors.

- Connector type: 3-pin COMBICON (Phoenix Contact MSTB 2,5/3-GF-5.08)
- Mating connector: 3-pin COMBICON (Phoenix FKCT 2,5/ 3-STF-5,08 (No.: 1902314)

Connect an external power supply:

» Check the power configuration and coding label attached to the left side of the system for the exact configuration and pin assignment.

*Figure 6. Power configuration and coding label (example)*




» Plug an external DC power supply to PU20.

» Plug an external AC power supply to PU21.



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## 2.5 Starting Up the System

The MH70S can be delivered with the OpenMediaVault operating system for creating an NAS or a Linux image already installed or without any operating system.

See the MEN website for all available software.

Carry out the following steps to start up the system:

» Power up the system using the power button on the control panel.

See Chapter 3.1 Power Button on page 28.

If an operating system is preinstalled:

» The operating system starts a mini setup on first boot and installs the drivers.

» Now you can make personalized settings, e.g., create a user account.



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# 3 Functional Description

The following describes the individual components and plug-in boards of the system. A detailed description of each board can be found in the respective user manual.

## 3.1 Power Button

With the PSU(s) in standby mode, pressing the front panel power button starts the system.

### Power Button Graceful Shutdown

The system shuts down gracefully when you press and release the power button. When the system has shut down, the PSU(s) is/are in standby mode.

### Power Button Hard Shutdown

A hard system shutdown is initiated when you press and hold the power button. When the system has shut down, the PSU(s) is/are in standby mode.

## 3.2 System Management

The system is managed using an internal shelf controller with the following main functionality:

- Signaling system status to the application software
  - External voltage status
  - Power supply failures
  - Power supply voltage levels
  - Temperature
  - Fan speed and status
- Fan control based on temperature
- Forced system shutdown in case of
  - abnormal temperature
- System start delay if
  - temperature too low

In normal operation you do not have to make any changes in the configuration.

See the MEN website for more information on the AF2 shelf controller.



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## 3.3 Control Panel LEDs

The status of the MH70S is signalled using LEDs at the front of the system. The following table shows the function and behavior of the LEDs.

*Table 1. Control panel LEDs*

| Appearance | Label | Color | Function |
|---|---|---|---|
| Powered by UPS<br>UPS Precharge | *Powered by UPS* | Yellow | Reserved for future use |
| | *UPS Precharge* | Yellow | Reserved for future use |
| Sys Status | *Sys Status* | Green | ▪ Blinking slowly: soft-off or waiting until start condition satisfied<br>▪ Blinking fast: system is shutting down<br>▪ On: normal operation<br>▪ Off: shelf controller powered off |
| Voltage Fail<br>Fan Fail<br>Temp Fail | *Voltage Fail* | Red | ▪ On: shelf controller or PSU detects a problem in the system power supply<br>▪ Off: all other states |
| | *Fan Fail* | Red | ▪ On: fan failure is detected<br>▪ Off: all other states |
| | *Temp Fail* | Red | ▪ Blinking: system temperature too cold<br>▪ On: system temperature too hot<br>▪ Off: all other states |



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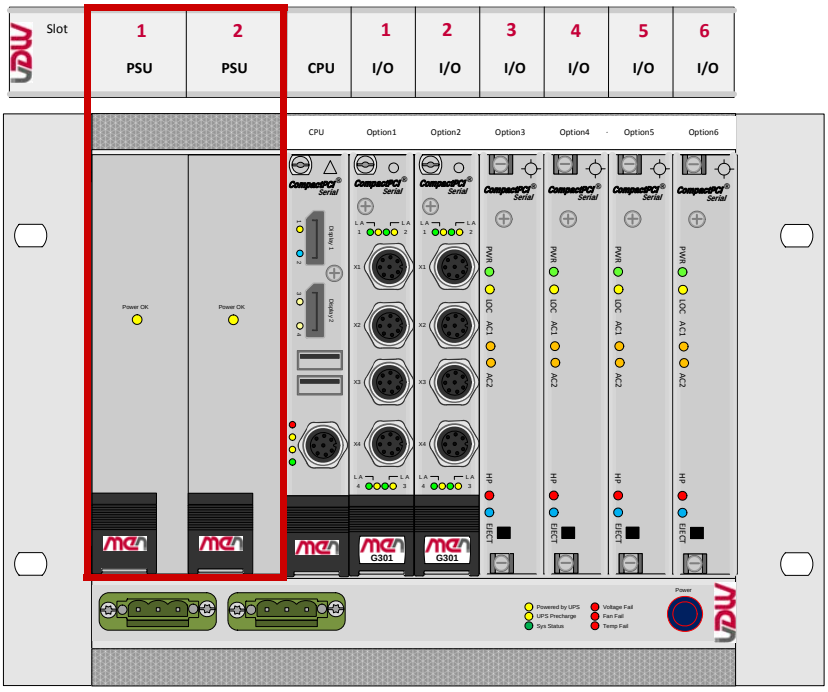
## 3.4 PSU Slots

The two PSU slots can either be equipped with two DC power supplies (PU20), two AC power supplies (PU21) or one DC power supply and one AC power supply.

*Figure 7. PSU slots*




- PU20 – 3U 6 HP PSU Wide-Range Power Supply Unit for Railway Systems, 24 to 110 VDC, 120 W
  www.men.de/products/pu20/
- PU21 – 3U 6 HP PSU Wide-Range Power Supply Unit for Railway Systems, 100 to 240 VAC, 120 W
  www.men.de/products/pu21/

See Chapter 2.4.4 Connecting the Power Supply on page 26 for further information about power supply connection.



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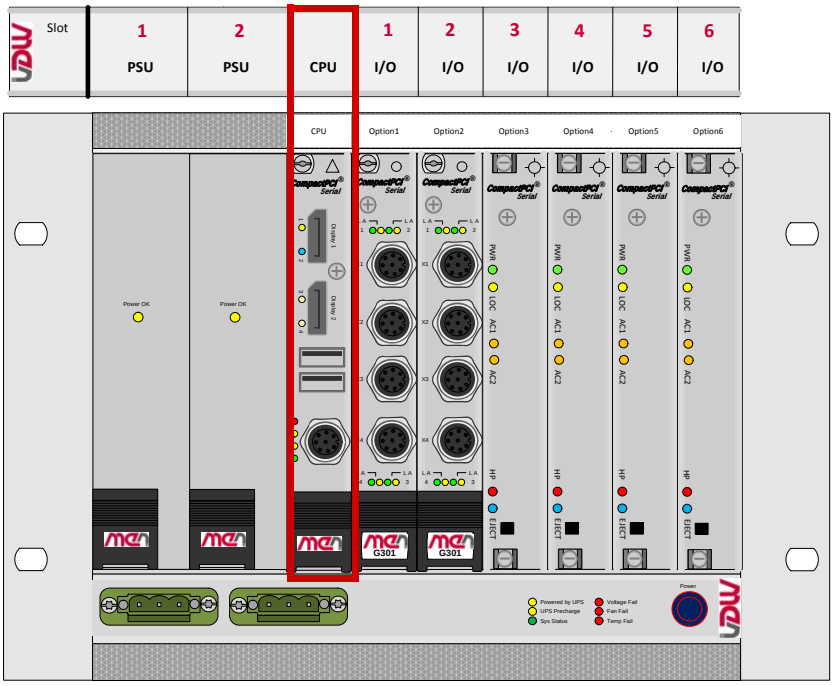
## 3.5 System Slot

The MH70S is controlled using the MEN standard G23 CompactPCI Serial CPU board in the system slot.

*Figure 8. CPU slot*




For detailed information on the G23 see data sheet and user manual on MEN's website.

### 3.5.1 Processor Core

G23 versions with two different processor types can be used in the MH70S. The following table shows the possible processor versions and a performance overview:

*Table 2. Processor core options for the MH70S*

| Processor Type | Base Frequency | Turbo Boost Frequency | Cores/ Threads | Power Consumption | L2 Cache | AMT Support |
|---|---|---|---|---|---|---|
| Core i7-4700EQ | 2.4 GHz | 3.4 GHz | 4/8 | 47 W | 6 MB | yes |
| Celeron 2002E | 1.5 GHz | n/a | 2/2 | 25 W | 2 MB | no |

Note: In a system equipped with the Intel Core i7 processor, fans have to be used for cooling in any case.



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### 3.5.2 Active Management Technology (AMT)

MH70S systems equipped with an Intel Core i7 processor support Intel Active Management Technology (AMT 9.0). Intel AMT is powered by a separate hardware engine in Intel chipsets which enables e.g. out-of-band (OOB) diagnostics, remote control, IDE-Redirect, Serial-over-LAN (SOL), agent presence checking and network traffic filtering.

AMT is supported on the lower front Ethernet interface (ETH2) of the CPU board.

MEN provides an application note on how to switch on the AMT functionality and log onto the CPU board via VNC afterwards. See MEN's website.

If the supercapacitor and/or the battery is empty, the MH70S loses its complete AMT settings due to Intel's security standards.

### 3.5.3 Trusted Platform Module (TPM)

A trusted platform module to protect the content of the SATA storage devices is available on the MH70S. The TPM module is compliant to the TPM v1.2 specification.

It can be used for digital rights management.

### 3.5.4 Memory and Mass Storage

#### 3.5.4.1 DRAM System Memory

The MH70S provides 4 or 16 GB onboard, soldered DDR3 (double data rate) SDRAM.

#### 3.5.4.2 mSATA

The MH70S can either be equipped with an 8 GB or a 32 GB mSATA disk.

### 3.5.5 Front Interfaces

The following interfaces are available at the front of the G23 CPU board:

- 2 Ethernet ports on standard RJ45 connectors
- 2 USB 3.0 ports
- 2 DisplayPort interfaces



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## 3.6 Peripheral Slots

### 3.6.1 Wireless Functionality via PCI Express Mini Cards

The MH70S system offers the possibility to implement up to four PCI Express Mini cards. The following options are available:

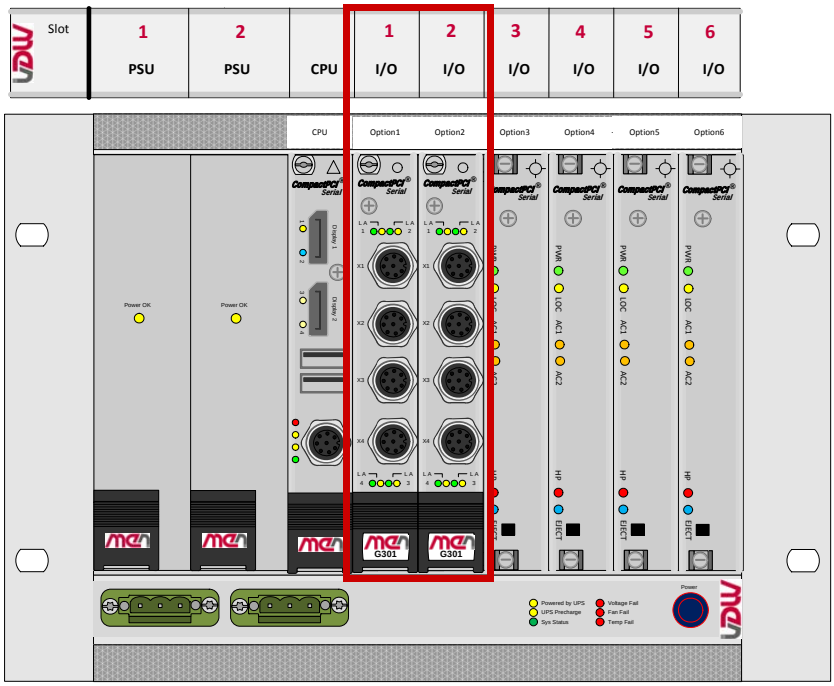
- WLAN
- UMTS
- LTE

The functionality is implemented using MEN plug-in board G212.

G212 – 3U CompactPCI Serial PCIe Mini Card Carrier
www.men.de/products/g212/

Possible in CompactPCI Serial peripheral slots: 1, 2.

*Figure 9. Peripheral slots usable for wireless functionality*



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### 3.6.2 Ethernet Interface Functionality

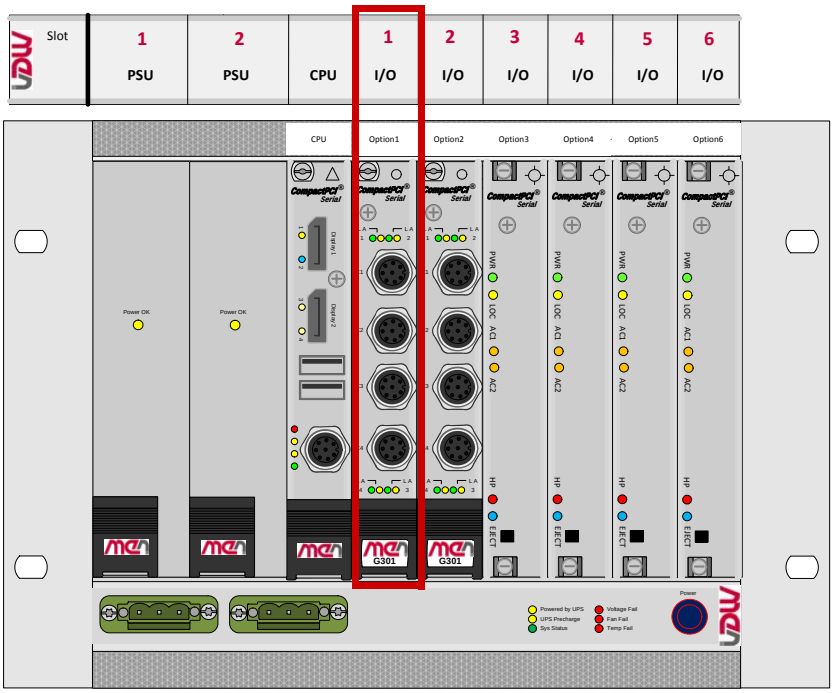
The MH70S system offers the possibility to implement four 10/100/1000Base-T interfaces on the first CompactPCI Serial slot.

The functionality is implemented using the MEN plug-in board G211.

G211 – 3U CompactPCI Serial Quad Gigabit Ethernet Interface
www.men.de/products/g211/

Possible in CompactPCI Serial peripheral slots: 1

*Figure 10. Peripheral slots usable for Ethernet interface functionality*



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### 3.6.3 Ethernet Switch Functionality

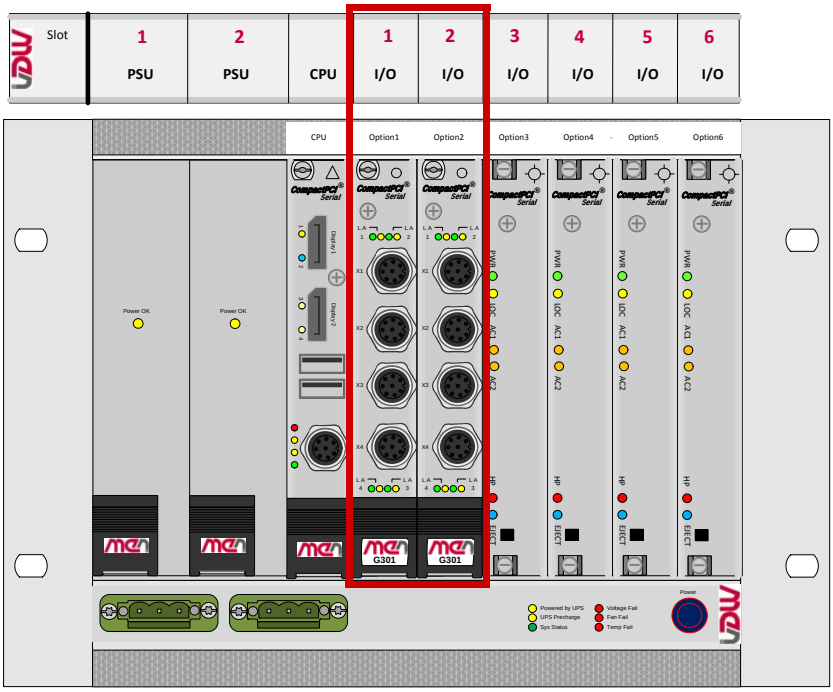
The MH70S system offers the possibility to implement one or two unmanaged 4-port Ethernet switches.

The functionality is implemented using the MEN plug-in board G301.

G301 – Unmanaged 4-Port Rugged Industrial Ethernet Switch
www.men.de/products/g301/

Possible in CompactPCI Serial peripheral slots: 1, 2.

*Figure 11. Peripheral slots usable for Ethernet Switch functionality*



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### 3.6.4 Mass Storage Functionality

The MH70S system provides the possibility to implement up to five HDD carriers for two 2.5" SATA HDD/SSD each.

Main features:

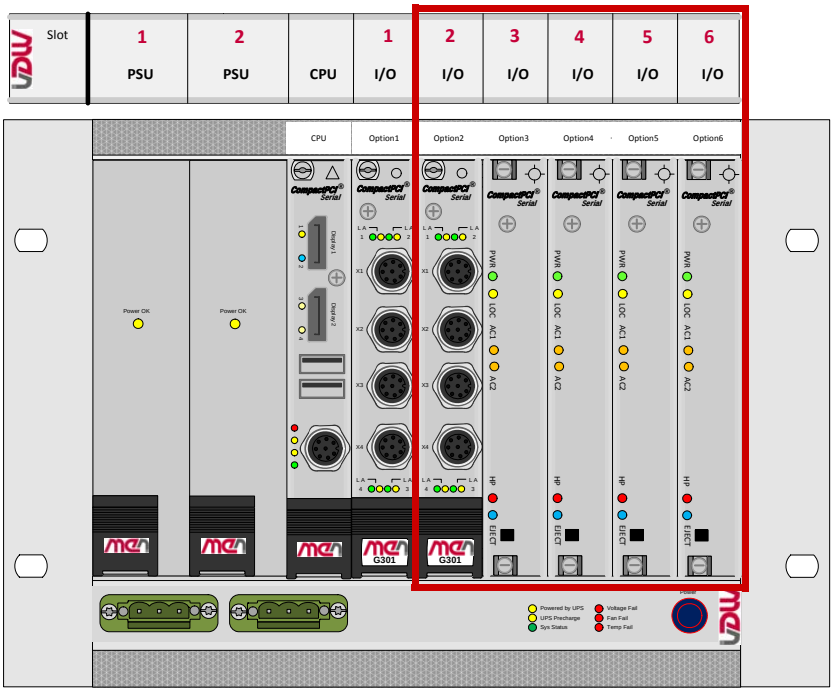
- Up to 20 TB storage capacity (depending on RAID level and HDD sizes)
- 500 Mbit/s data transfer rate in a RAID 5 configuration with 10 HDDs installed (5 transparent for CPU)
- RAID levels 0, 1 and 5 with hot-spare disc on system level (depends on operating system support)
- RAID levels 0, 1 and JBOD on one G503 carrier
- Hot swap support
- Automatic rebuild
- SMART Monitoring

The functionality is implemented using the MEN plug-in board G503.

G503 – 3U CompactPCI Serial SATA HDD/SSD Shuttle
www.men.de/products/g503/

Possible in CompactPCI Serial peripheral slots: 2, 3, 4, 5, 6.

*Figure 12. Peripheral slots usable for mass storage functionality*



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## 3.7 Third-Party Plug-In Boards

The MH70S is not intended for use with third-party 3U plug-in boards. Use only cards provided by MEN and verified for usage with the MH70S system.

Please contact MEN if you have specific needs regarding implementation of third-party boards.



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# 4 Maintenance

## 4.1 Cleaning the System

The system should be cleaned once a year. Clean the bottom and top plate, remove dirt and dust from air ventilation holes. Light dirt can be removed with a dry cloth. Persistent dirt should only be removed with a mild detergent and a soft cloth.

Take care that no liquid gets inside the system and the license labels are not damaged.

## 4.2 Lithium Battery

The CPU board contained in this system is equipped with a lithium battery. There is a danger of explosion if the battery is incorrectly replaced!

- Replace only with the same or equivalent type.
- Manufacturer: Renata
- Type: CR2032
- Capacity: 235 mAh
- The battery has to be UL listed.

Used batteries have to be disposed of according to the local regulations concerning the disposal of hazardous waste.

The user manual of the CPU board gives detailed information regarding the position of the battery.
You can download the user manual on the MEN website.

## 4.3 Fuse Protection

Specific interfaces of individual components and plug-in boards of the system are protected by fuses. A detailed description of fuse protection can be found in the respective user manual.

Fuses are not intended to be exchanged by the customer. Your warranty for the MH70S will cease if you exchange fuses on your own. Please send the product to MEN for repair if a fuse blows.



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The following components use fuses:

- PU20 – 3U 6 HP PSU Wide-Range Power Supply Unit for Railway Systems, 24 to 110 VDC, 120 W
  www.men.de/products/pu20/
- PU21 – 3U 6 HP PSU Wide-Range Power Supply Unit for Railway Systems, 100 to 240 VAC, 120 W
  www.men.de/products/pu21/



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## 4.4 Exchanging Plug-In Boards

The individual plug-in boards can be removed from the system and be exchanged.

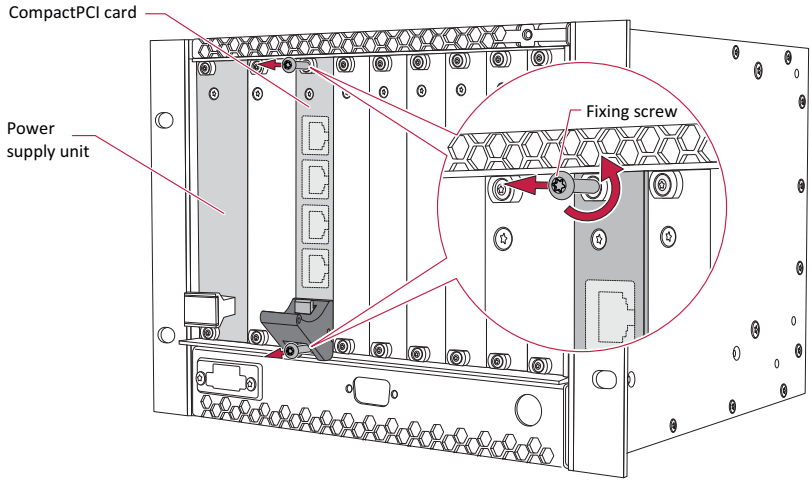
- Works on the computer system may only be carried out by personnel qualified for the specific task, who, based on their training and experience, are able to identify risks and avoid potential hazards when working with these products/systems.
- Always power off the system before removing plug-in cards.

Observe the instructions concerning electrostatic discharge listed in Chapter Electrostatic Discharge (ESD) on page 6 when you carry out works on the computer system.

### *Removing a Plug-In Board*

To remove a plug-in board carry out the following steps:

» Loosen the fixing screws of the assembly you want to remove (highlighted in red).




» Press down the red switch on the ejector.



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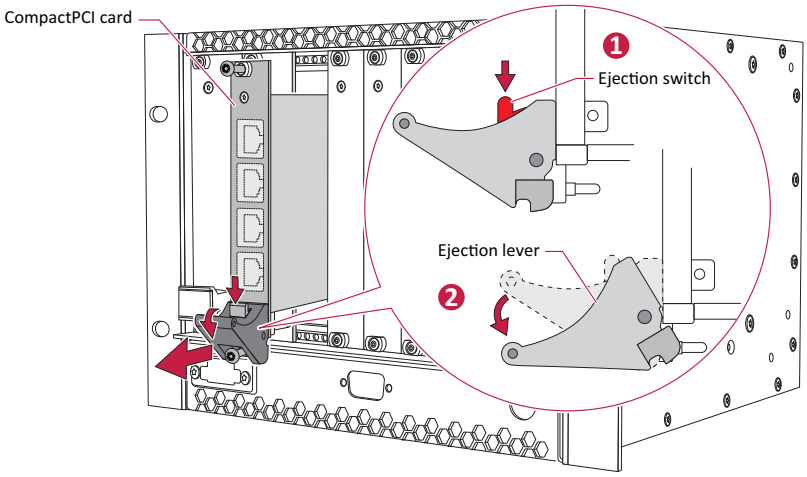
» Keep the switch pressed and move the ejector down.




» The assembly can now be removed from the system.

***Reinserting a Plug-In Board***

» Make sure that you insert the assembly into the correct slot. The slots for the PSUs are marked by gray guide rails. The CPU board may only be inserted into the system slot. The system slot has got red guide rails and is marked by a triangle next to the upper fixing screw.

» Insert the assembly into the guide rails. Make sure that the board is exactly situated in the top and the bottom guide rail.

» Slide the assembly into the slot until you notice a resistance.

» Turn the ejector up until it clicks into place.

» Re-fasten the fixing screws.



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## 4.5 Installing Hard Disks

***Perform the following steps to install the hard disks:***

- Power down your system.
- Remove the MH70S from the system.
- If there are already hard disks installed, follow the instructions given in Chapter Removing a Hard Disk on page 1.

***For installing the hard disk on the left side:***

- Place the hard disk on the MH70S and align it with the guide rails.
- Align the SATA connector on the hard disk with the SATA connector on the MH70S.
- Firmly plug the hard disk into the SATA connector on the MH70S.

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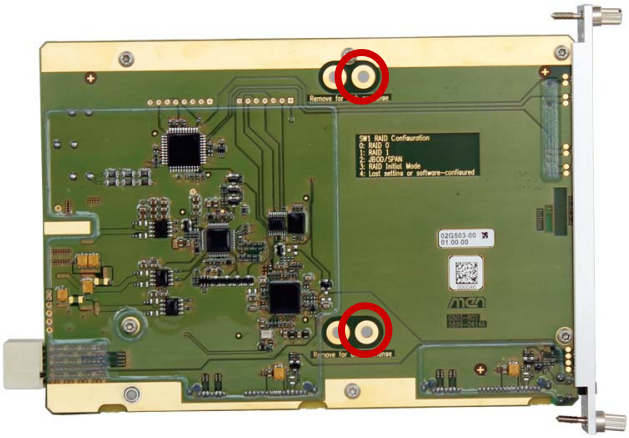
» Fasten the hard disk to the board from the other side using two of the four M3x8 TX8 socket head screws supplied with the MH70S (position highlighted in red in the following drawing).



» Secure the hard disk additionally by fixing it to the front panel using one of the M3x6 TX8 screws supplied with the MH70S.

» Apply thread locker to ensure the screws are not loosened by vibrations

***For installing the hard disk on the right side:***

» Slide the hard disk into the guide rail at the right side.

» Align the connector at the rear of the hard disk with the SATA connector on the MH70S.

» Firmly plug the hard disk into the SATA connector on the MH70S.

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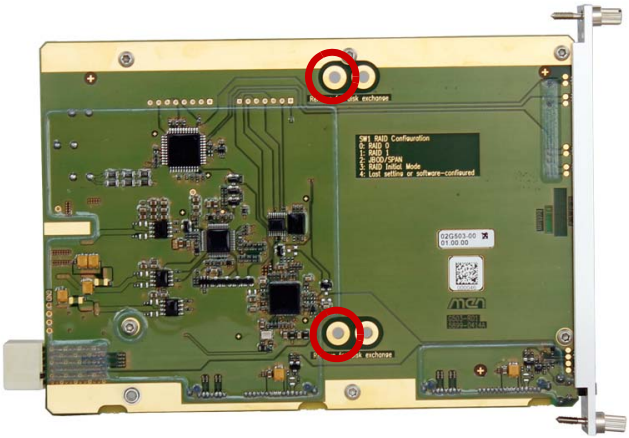
» Fasten the hard disk to the board from the other side using two of the four M3x8 TX8 socket head screws supplied with the MH70S (position highlighted in red in the following drawing).



» Secure the hard disk additionally by fixing it to the right guide rail using one of the M3x6 TX8 screws supplied with the MH70S

» Apply thread locker to ensure the screws are not loosened by vibrations

## 4.6 Removing a Hard Disk

Perform the following steps to remove the hard disks:

» Remove the six screws holding the hard disks in place.

» Unplug the hard disks from the MH70S's SATA connectors.

» Slide the right hard disk out of the guiding rail.



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# 4 TARJETA DE COMUNICACIONES PARA MAR



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# Sierra Wireless AirPrime®
# Embedded Wireless Modules
# MC Series

## High-speed connectivity in a mini-card form factor

Sierra Wireless AirPrime® MC Series supports the latest 4G and 3G networks in North America, Europe, and Asia. Optimized for low power consumption, the MC Series is ideal for today's mobile computing, networking, and industrial IoT applications.

### DEPLOY ON THE WORLD'S FASTEST LTE NETWORKS

The MC Series supports 3G and 4G global networks, including LTE Advanced, with automatic fallback to 3G and 2G networks depending on the module variant.

### ENABLE LOCATION BASED SERVICES

GNSS tracking lets you locate, monitor, and deploy location-based applications and services with module variants supporting GPS, GLONASS, Beidou, and Galileo satellite systems.

### INCORPORATE CLOUD CONNECTED SOLUTIONS

Update firmware, manage applications, and utilize product data over-the-air with AirVantage® cloud connectivity (some module variants require a Linux SDK).

### SWITCH NETWORKS ANYTIME

The MC74xx module variants allow device manufacturers to store up to three different firmware variants on-board, while the MC73xx has the same functionality via host download, simplifying logistics and supply chain management.

Image shown in actual size
(51 x 30 x 2.7mm)

### EASY TO INTEGRATE AND MANAGE

The MC Series can be managed remotely with AirVantage® Management Service, enabling device manufacturers to securely upgrade device firmware over-the-air. This can extend the life of your products and solutions by future-proofing remote assets, expanding service quality, and saving customers time and operating costs.

**Essential**

SIERRA WIRELESS | AirPrime®

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# Sierra Wireless AirPrime® Embedded Wireless Modules MC Series

## Specifications

| | MC7455* | MC7430* | MC73XX | MC870X | MC9090/MC809X |
|---|---|---|---|---|---|
| **AIR INTERFACE** | | | | | |
| | LTE-FDD, LTE-TDD HSPA+ | LTE-FDD, LTE-TDD HSPA+, TD-SCDMA | "LTE,HSPA+,GSM/GPRS/EDGE, EV-DO Rev A, 1xRTT (MC7354/50)" | HSPA+,GSM/GPRS/EDGE | "HSPA+,GSM/GPRS/EDGE, EVDO (MC9090)" |
| **DATA SPEED** | | | | | |
| Peak Download Rate | 300 Mbps | 300 Mbps | 100 Mbps | 21.1 Mbps | "HSPA+ 14.4Mbps<br>EVDO 3.1Mbps (MC9090)" |
| Peak Upload Rate | 50 Mbps | 50 Mbps | 50 Mbps | 5.76 Mbps | "HSPA+ 5.76Mbps<br>EVDO 1.8Mbps (MC9090)" |
| **FREQUENCY BANDS** | | | | | |
| LTE | B1-B5, B7, B12, B13, B17, B20, B25, B26, B29, B30, B41 | B1, B3, B5, B7, B8, B18, B19, B21, B28, B38-B41 | "MC7304: B1, B3, B7, B8, B20<br>MC7330: B1, B19, B21<br>MC7354: B2, B4, B5, B13, B17, B25<br>MC7350: B4,B13,B25" | | |
| WCDMA | B1, B2, B3, B4, B5, B8 | B1, B5, B6, B8, B9, B19 | MC7304: B1, B2, B5, B8<br>MC7330: B1, B5, B6, B19<br>MC735: B1, B2, B4, B5, B8 | 850/900/1900/2100 MHz | MC9090: 800/850/1900/2100 MHz<br>MC8090: 850/1900/2100 MHz<br>MC8092: 900/2100 MHz |
| TD-SCDMA | | B39 | | | |
| CDMA 1xRTT/EV-DO Rev A | | | MC7354/50: BC0,BC1,BC10 | | 800/1900 MHz (MC9090) |
| GSM/GPRS/EDGE | | | Quad-Band<br>MC7350: None | Quad-band | Quad-Band |
| **APPROVALS** | | | | | |
| Regulatory | Planned: FCC, IC, CE, NCC, GCF, PTCRB | Planned: JRF/JPA, NCC | MC7304: CE, GCF, NCC, FCC<br>MC7330: JRF/JPA, NCC<br>MC7354: FCC, PTCRB, NCC<br>MC7350: FCC, NCC | CE, FCC, IC, NCC, PTCRB, GCF-CC | MC9090: FCC, IC, PTCRB, NCC<br>MC8090: FCC, IC, PTCRB<br>MC8092: CE, GCF-CC |
| Carrier | Planned: AT&T, Verizon, Sprint, Vodafone, Telefonica, Orange | Planned: docomo, Telstra | MC7304: Telstra, Vodafone<br>MC7330: docomo<br>MC7354: AT&T, Verizon, Sprint<br>MC7350: Verizon Sprint | MC8704: Bell, Telstra, Telus, NZ Telecom<br>MC8705: AT&T | MC9090: AT&T, Sprint, Verizon<br>MC8090: AT&T<br>MC8092: docomo |
| **CPU PERFORMANCES** | | | | | |
| IO voltage | 1.8V | 1.8V | 1.8V | 1.8V (MC8704) | 1.8 V |
| **INTERFACES** | | | | | |
| UART | | | | | "MC9090: 1X 8 wire<br>MC809x: 1x 4-Wire" |
| USB | "USB 3.0<br>USB 2.0 High Speed" | "USB 3.0<br>USB 2.0 High Speed" | USB 2.0 High Sped | USB 2.0 High Speed | USB 2.0 High Speed |
| Main Radio Disable | ✓ | ✓ | ✓ | ✓ | ✓ |
| Vref | 1.8V | 1.8V | 1.8V | 1.8V | 1.8V |
| GPIO | 4 | 4 | 4 | 6 | 4 |
| Flash LED output | 1 | 1 | 1 | 1 | 1 |
| Audio | PCM/I2S** | PCM/I2S** | PCM/I2S | MC8704: I2S | PCM |
| SIM interface | 2x 1.8 or 3V | 2x 1.8 or 3V | 1.8 or 3V | 1.8 or 3V | 1.8 or 3V |
| **ANTENNA** | | | | | |
| Connectors | Main, Aux/GNSS, GNSS | Main, Aux/GNSS, GNSS | MC7354: Main, Aux/GNSS, GNSS<br>MC7350/04/30: Main, Aux, GNSS | Main, Aux/GNSS | Main, Aux, GNSS |
| Diversity | ✓ | ✓ | ✓ | ✓ | ✓ |
| MIMO | ✓ | ✓ | ✓ | | |
| GNSS Bias | ✓ | ✓ | ✓ | | |
| **LOCATION SOLUTION** | | | | | |
| Satellite Systems | GPS, Glonass, Beidou, Galileo | GPS, Glonass, Beidou, Galileo | GPS, Glonass | GPS | GPS |
| Modes*** | Standalone, SUPL 2.0, XTRA 3.0 | Standalone, SUPL 2.0, XTRA 3.0 | Standalone, SUPL 2.0, XTRA 2.0 | Standalone, SUPL 1.0, XTRA 1.0 | Standalone, SUPL 1.0, XTRA 1.0 |
| **CONTROL OPTIONS** | | | | | |
| | APIs, AT Commands | APIs, AT Commands | APIs, AT Commands | APIs, AT Commands | APIs, AT Commands |
| **DRIVERS** | | | | | |
| Windows® 7 | ✓ | ✓ | ✓ | | |
| Windows® 8 | ✓ | ✓ | ✓ | | |
| Windows® Mobile 6.5 | | | ✓ | ✓ | ✓ |
| Windows® CE 6.0 | | | ✓ | ✓ | ✓ |
| Android | ✓ | ✓ | ✓ | ✓ | ✓ |
| Linux | ✓ | ✓ | ✓ | ✓ | ✓ |
| **DEVICE DIMENSIONS** | | | | | |
| | 51 x 30 x 2.7mm | 51 x 30 x 2.7mm | 50 x 30 x 2.7mm | 51 x 30 x 4.5mm | 51 x 30 x 4.5mm |
| **OPERATIONAL TEMPERATURE** | | | | | |
| | TBD | TBD | -40°C to +85°C | -25°C to +75°C | -40°C to +85°C |

* Available in 2H 2015
**FW support for voice is a future FW update
***Exact GPS modes supported may be SKU and Operator dependent

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# 5 TARJETA DE COMUNICACIONES PARA SISTEMAS DE ALIMENTACIÓN ININTERRUMPIDA



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# TARJETAS RED ETHERNET / SNMP

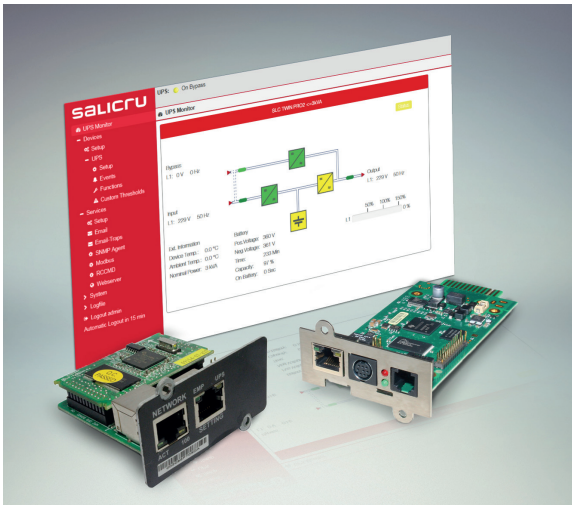
## Cierre ordenado de servidores

### Tarjetas Red Ethernet / SNMP: Los mejores complementos para proteger su red informática

Ante cualquier problema eléctrico -corte de suministro, pico de tensión o bajada de línea- la principal funcionalidad de un Sistema de Alimentación Ininterrumpdia (SAI/UPS) es proteger a las cargas conectadas y continuar alimentando a nuestra red informática, ya sea desde las baterías o bien regulando la tensión de suministro.

Para conocer en todo momento si el SAI está funcionando correctamente es muy importante la monitorización del mismo, para que nos pueda avisar de su correcto funcionamiento y/o gestionar el cierre completo y ordenado de nuestra red informática, es por ello que se requiere la instalación de una tarjeta de Red Ethernet en el SAI, para que de forma autónoma pueda gestionar las distintas funcionalidades que requiera nuestra red informática.

Salicru dispone de un completo abanico de tarjetas de red **Ethernet / SNMP**, para dar respuesta a los requerimientos de nuestros clientes.



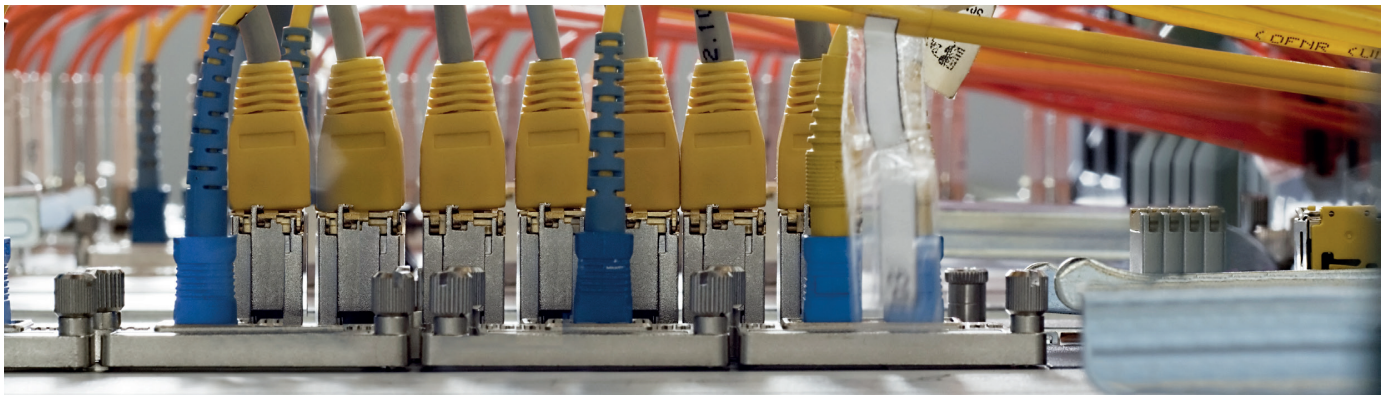

## Adaptador Ethernet / SNMP WEB Adapter

Las funcionalidades que incorporan estas tarjetas podrán satisfacer las necesidades más exigentes de los administradores TI. Son rápidamente configurables facilitando su trabajo, disponen de amplias opciones de monitorización y personalización de eventos, completas opciones en el apagado ordenado / encendido (wake on lan) de nuestro parque de servidores físicos o virtuales, pasarela SNMP (v2,v3) y MODBUS (tcp), uso de SSL mediante certificados digítales propios del cliente y protocolo BACnet para la automatización de edificios.

Opcionalmente permite la conexión y gestión de sondas de temperatura / humedad, envío de SMS mediante modem GSM, y la gestión de contactos libres de potencial.

## Adaptador Ethernet Básico / SNMP WEB Adapter

Esta tarjeta de bajo coste, permite una básica monitorización local en forma de tabla, permite el envío de correos electrónicos de forma automática y no personalizables, y una gestión de eventos estática, y recomendada para su gestión a partir de software de terceros por SNMP (Nagios, Zabbix, Pandora, Prtg, OpenView, Tivoli, etc).



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| DESCRIPCIÓN | ADAPTADOR ETHERNET / SNMP WEB ADAPTER | ADAPTADOR ETHERNET BÁSICO / SNMP WEB ADAPTER |
|---|---|---|
| Compatible con todas las series con SLOT de **Salicru** | Sí | No |
| Asistente de fácil configuración | Sí | No |
| Visualización de datos | Gráfico, esquema bloques | Tabla |
| Apagado ordenado de servidores | Sí, mediante eventos, para la mayoría de Sistemas operativos físicos / virtuales | Básico para Windows / Linux |
| Configuración SMTP | Configurable, permite encriptación, personalización puertos | Standard |
| Envío de alertas por mail | Automático y/o permite personalizar qué alertas enviar, y en qué momento | Automático, no personalizable |
| Eventos personalizables según valores / medidas SAI | Sí | No |
| Compatibilidad SNMP | SNMP V2 y V3 | SNMP V2 |
| Histórico de eventos y medidas | Personalizable, visualización texto y gráfica,permite exportar a Excel | Eventos y Medidas en tabla |
| Protocolo MODBUS | TCP y RS232 | No |
| Protocolo BACnet | Sí | No |
| Seguridad de acceso | Mediante login y password, configurable | No |
| Programación de acciones calendarizadas | Sí | Sí |
| Opción módem SMS | Sí | No |
| Opción relés gestionables | Sí | No |
| Opcional Sonda Temperatura / Humedad | Sí | No |

Datos sujetos a variación sin previo aviso.

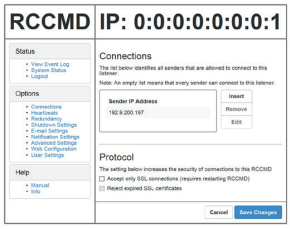
## RCCMD: Aplicación de shutdown remoto

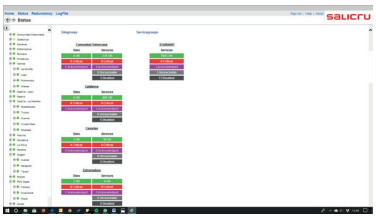
Software agente para la mayoría de sistemas operativos físicos / virtuales. Las diferentes acciones (shutdown, mensaje, acción) son ejecutadas por scripts personalizables, al recibir la orden desde el Adaptador Ethernet / SNMP WEB Adapter. Compatible con la mayoría de los sistemas operativos, incluso sistemas virtualizados (vmware, citrix e hyperv).

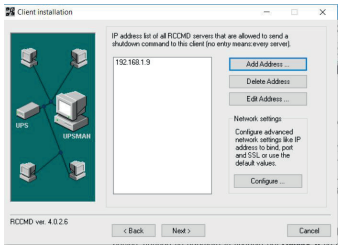
Software licenciado por servidor físico a gestionar, cada adaptador incluye una licencia, para más servidores se requiere adquirir licencias adicionales. Dispone de la opción segura mediante SSL.

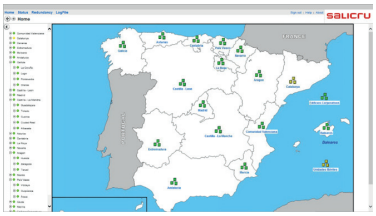
## UNMS II: Gestión de los SAIs Salicru sin límites

Software para la monitorización centralizada de un amplio parque de SAIs instalados en nuestra empresa. El **UNMS II** se instala como un servicio WEB para facilitar la monitorización y gestión. El **UNMS II** es un software escalable que dispone de diferentes niveles de licencia según los equipos a monitorizar, desde el nivel básico y gratuito, de 9 SAIs, hasta instalaciones de más de 2.500 SAIs.





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| Firmado Por | MANUEL FERNANDEZ FERNANDEZ | | |
| | IGNACIO SUAREZ LOPEZ | | |
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