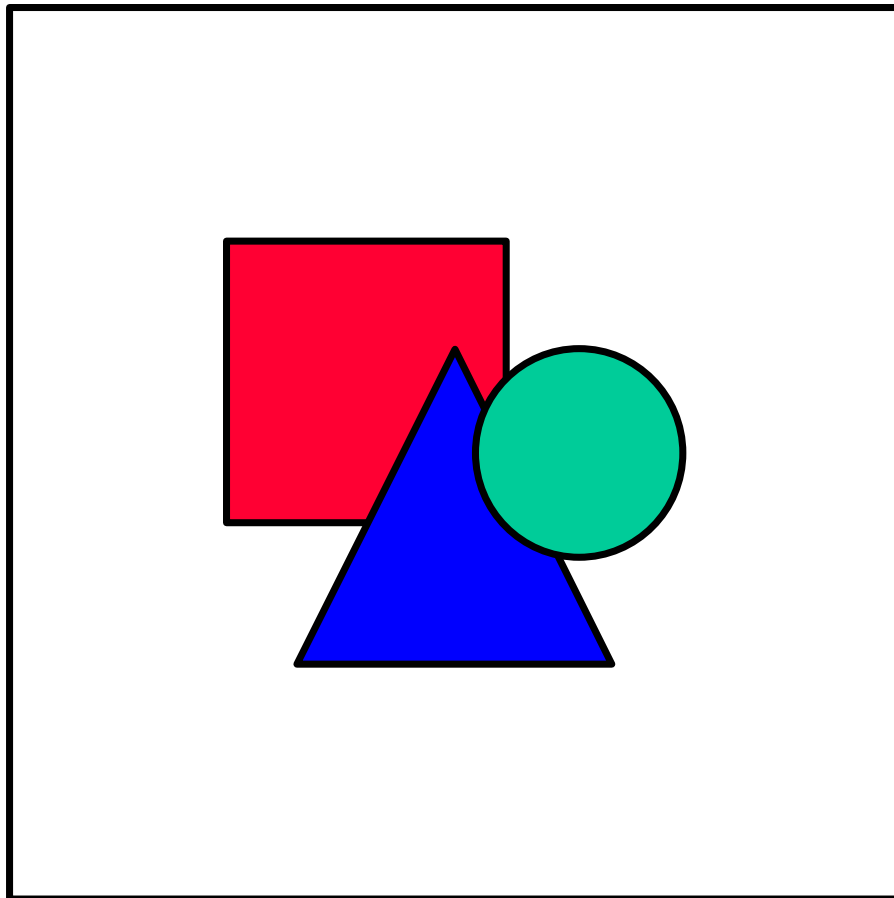




Technical Manual

Automated Inventory Control System



Gemstar Communications Inc.
760 Pacific Road, Unit 7, Oakville, Ontario L6L 6M5

Notice

Copyright © 1998 Gemstar Communications Inc. ("Gemstar").

The information herein is provided without liability to any user. While every effort has been made to verify the accuracy and completeness of this information, Gemstar makes no guarantee as to its accuracy or applicability for any particular use. In every instance, it is the user's responsibility to determine the suitability of this product for their application. Gemstar reserves the right to revise product hardware, software, or documentation without obligation to notify any person or organization. Nothing contained herein shall be construed as a recommendation to use any product in violation of patents or other rights of third parties. The sale of any Gemstar product is subject to all Gemstar Terms and Conditions of Sale and Sale Policies, copies of which can be provided upon request.

This document contains proprietary information which is protected by copyright. All rights are reserved. No part of this document may be copied or reproduced in any form without the express written permission of Gemstar.

Trademarks

Product names mentioned in this manual may be trademarks, and they are used for identification only.

User Comments

In order for us to maintain the quality of our publications, we invite our customers to forward comments or suggestions to help us improve the effectiveness of this manual.

Part Number 1020010, Revision 0

First Printing: August, 1998

Printed in Canada

Table of Contents

Notice	i
Table of Contents	ii
System Overview	1
System Description.....	1
Technical Summary	2
Use and Purpose	2
Radio Frequencies.....	2
RF Power Output and Field Strength	2
Time Lines/Duty Cycle	2
System Block Diagram	4
Regulatory Approval Label Diagram	5
Component Description.....	7
Asset Management Tag.....	7
Tag Function	7
Tag Model Numbers.....	8
Tag Diagnostic Lights.....	8
Tag Attachment and Test Procedure	8
Tag Schematic Diagram & Parts List	9
MicroCell.....	10
MicroCell Function	10
MicroCell Model Numbers	10
MicroCell Diagnostic Lights.....	11
MicroCell Schematic Diagram & Parts List.....	11
On-Site Controller	12
On-Site Controller Function.....	12
OSC Model Numbers	12
OSC Diagnostic Lights	13
Maintenance Procedures	14
Principles of Operation	14
Installation Guide.....	14
Installation Checklist	14
Installation Procedures.....	16
Block Diagram of Tag RF and Modulating Circuitry	18
Block Diagram of MicroCell RF and Modulating Circuitry	18
Block Diagram of On-Site Controller RF and Modulating Circuitry	18
Performance Specifications	19
Tag.....	19
MicroCell	19
On-Site Controller	19
Host Computer Requirements.....	20

Notice to Users 20

Technical Support..... 21

 Service Standards..... 21

 Troubleshooting 23

Index 24

Appendix A..... 1

 Block Diagrams of Asset Tag RF and Modulating Circuitry 1

Appendix B..... 1

 Block Diagrams of MicroCell RF and Modulating Circuitry 3

Appendix C..... 1

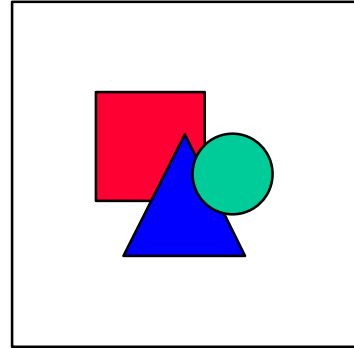
 Block Diagrams of On-Site Controller RF and Modulating Circuitry..... 1

System Overview

System Description

The Gemstar **Automated Inventory Control System (AICS)** is a wireless communications system that enables remote inventory tracking and asset management. This technical manual describes the system, its components and other information necessary for its regulatory approval, installation and operation. The specifications contained in this document pertain to the Gemstar GSAM Model AICS.

The key to the system is a small electronic device known as a “Tag” which is attached to each finished product at the manufacturing facility. The Tag remains attached to the piece as it travels from the manufacturing facility to the distribution depot to the dealer site.



Asset Tag



MicroCell

Monitoring units called “MicroCells” detect signals from these Tags when they are on-site. Typically there are three or more MicroCells at each site to ensure complete coverage of the area.

When a MicroCell detects a tag, it stores this data and reports to the site’s On-Site Controller (OSC) on demand. The On-Site Controller is connected by dedicated telephone line to the company’s host computer, the Server, typically located at the Head Office.

Inventory can therefore be tracked from the Head Office as it moves from site to site until the equipment is sold and the tag is removed, transmitting an appropriate signal to the system.



On-Site Controller

Technical Summary

Use and Purpose

The Automated Inventory Control System (AICS) allows the user to obtain inventory data remotely from dealerships equipped with the system. The user can Poll the Server to download current data providing the following timely data of inventory equipped with Gemstar's Tags:

- inventory currently at the dealer
- inventory that has been transferred to another dealer
- missing inventory
- sold inventory-

Gemstar's MicroCell network, installed at the dealerships, monitors the tagged inventory and reports the data to a storage device or On-Site Controller (OSC). This data is accumulated and held at the OSC until the main server polls and uploads the data into its main database. The data can then be accessed by the Host user to generate the required reports.

Radio Frequencies

Data to be provided by UltraTech

RF Power Output and Field Strength

Data to be provided by UltraTech

Time Lines/Duty Cycle

Transmission Characteristics

Asset Management Tags transmits every 15 minutes when the strap is closed for a period of 8.6 milliseconds and every 6 minutes with the strap open. Based on a maximum duty cycle of 100 milli seconds, the duty cycle for the tag is 8.71 %

Power transmission on the fundamental frequency of 904.512 MHz has been measured at a peak level of 87.63 dB \oplus V/m.

Connection Mode

When the Tag Strap is first connected, the Tag will transmit a signal every two seconds for a total of twenty seconds.

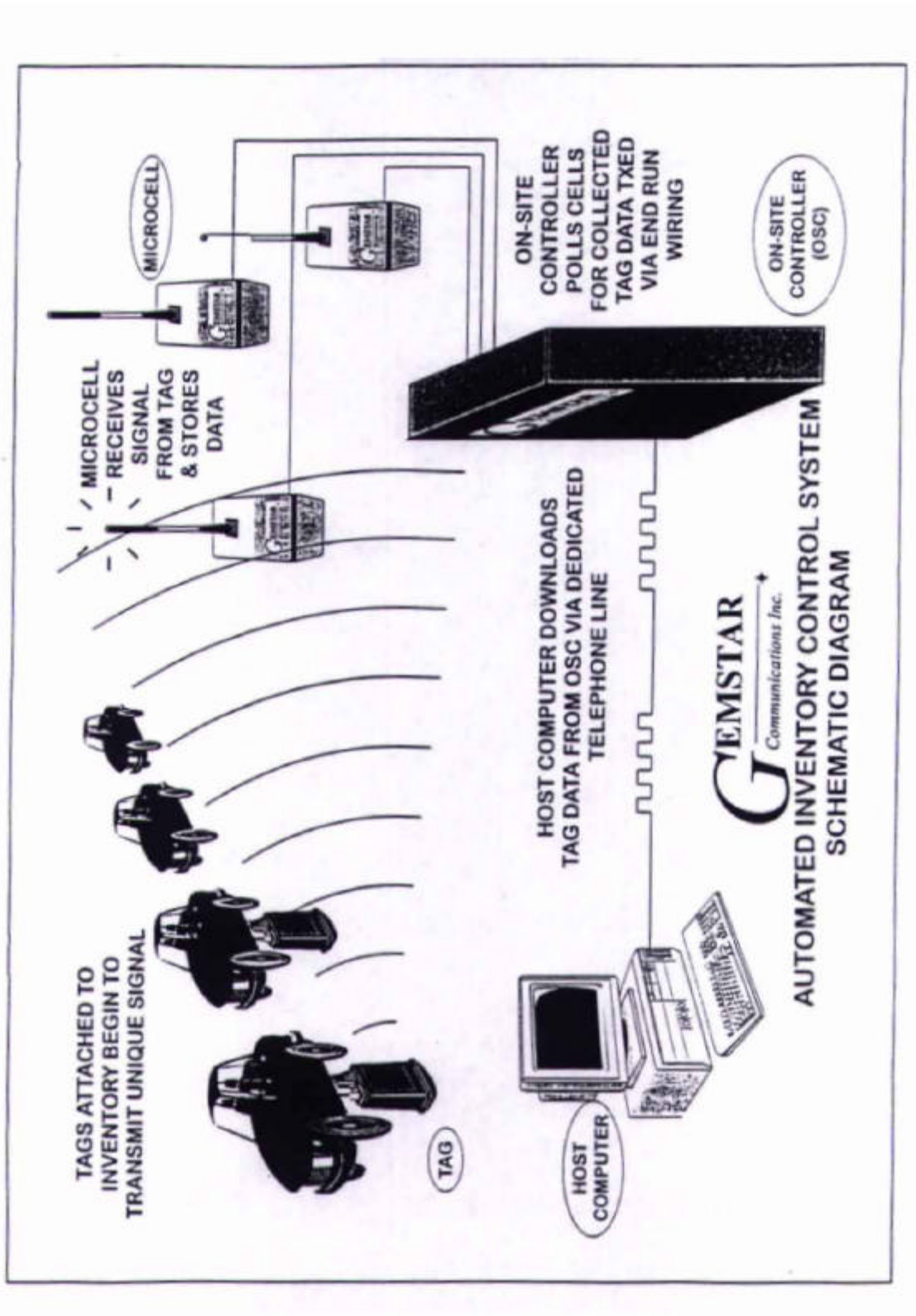
Normal Mode

Tags transmit four times per hour on the quarter-hour plus or minus 2 minutes during normal operation. The exact timing of the transmission within those parameters is randomly generated by computer algorithm.

Sold/Disconnect Mode

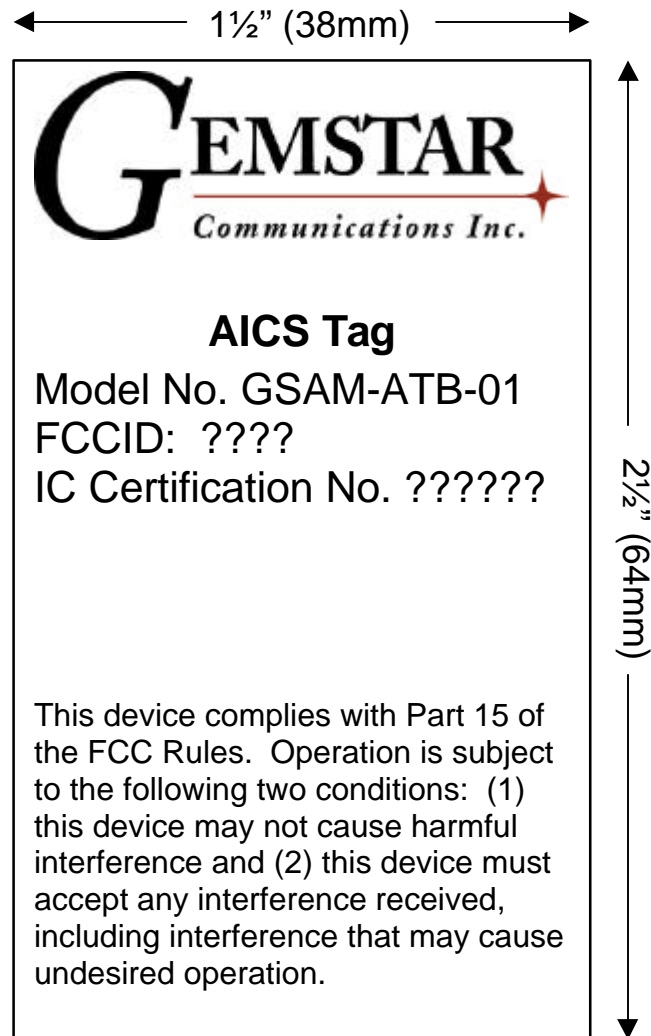
When the Tag Strap is removed (normally upon the sale of the equipment), the Tag transmits ten times per hour for twenty-four hours. Reconnection of the Tag Strap during this time period will have no effect on the transmissions. At the end of the twenty-four-hour period, the Connection Mode is enabled should the Tag Strap be reattached.

System Block Diagram



Regulatory Approval Label Diagram

The following notice label is typical of the type that must be attached to each component of the AICS:



The following illustrations show where on the equipment the labels are to be attached:



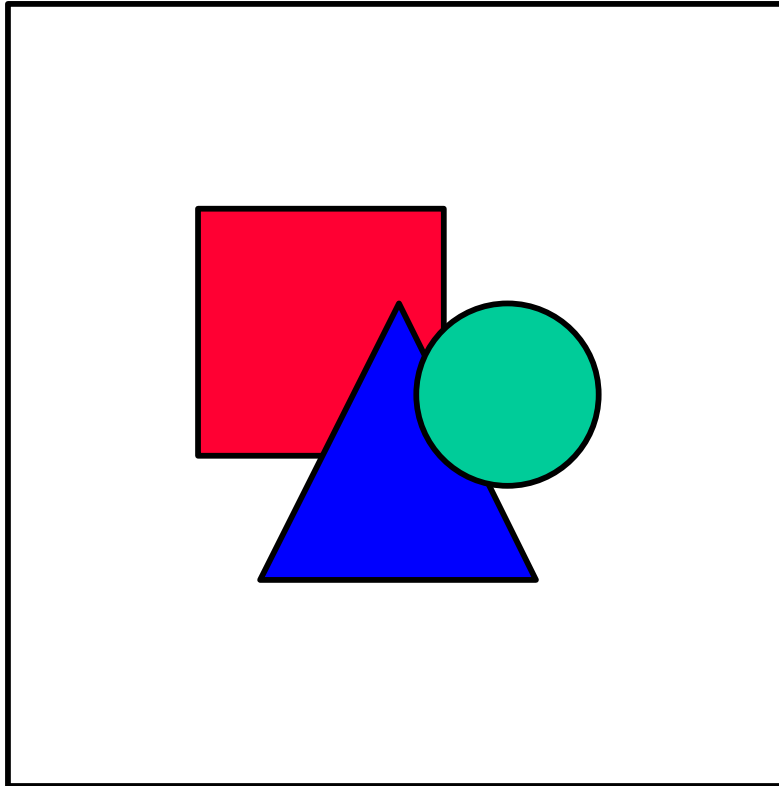
The tag notice label is affixed on the embossed area on the side opposite the Gemstar logo.

The Microcell notice label is affixed on the lower rear section of the case opposite the side with the Gemstar logo.



Component Description

Asset Management Tag



Tag Function

A microprocessor-based Radio Frequency (RF) transmitting device attached onto new vehicles during the manufacturing process. The tag is programmed to transmit a unique code, which is associated with the serial number of the inventory item in the Host computer. The attachment of the Tag is made using an integrated strap, which also provides the "status" of the Tag as well as acting as the antenna. The tag transmits its code randomly 4 times per hour under normal conditions. Once the strap is disconnected, the Tag then begins transmitting a "sold" status 10 times per hour for 24 hours and then resets itself.

Tag Model Numbers

Automated Inventory Control System (AICS) Tags are identified by serial number and one of the following model numbers:

GSAM-ATB-01 for basic Asset Tags;
GSAM-ATP-01 for Asset Tags "Plus".

The last two digits of the model number indicate the manufacturer's version of the device.

Tag Diagnostic Lights

LED NUMBER	COLOR	FUNCTION
D1	RED	Flashes every 2 sec. when transmitting. Stops flashing 24 hrs. after disconnect.

Tag Attachment and Test Procedure

ATTACHMENT

- Fill out New Tag Listing Form.
- Attach Tag to equipment as follows:
 1. Ensure the light on tag is not flashing prior to installation;
 2. Loop the loose end of the strap around attachment point;
 3. Plug the strap into the open connector on the tag and twist clockwise ½ turn;
 4. Ensure light on top of tag is flashing approximately every 2 seconds (the light will continue to flash every 2 seconds for 20 seconds and then flash once every 10 seconds.)
- Fax New Tag Listing to System Operator

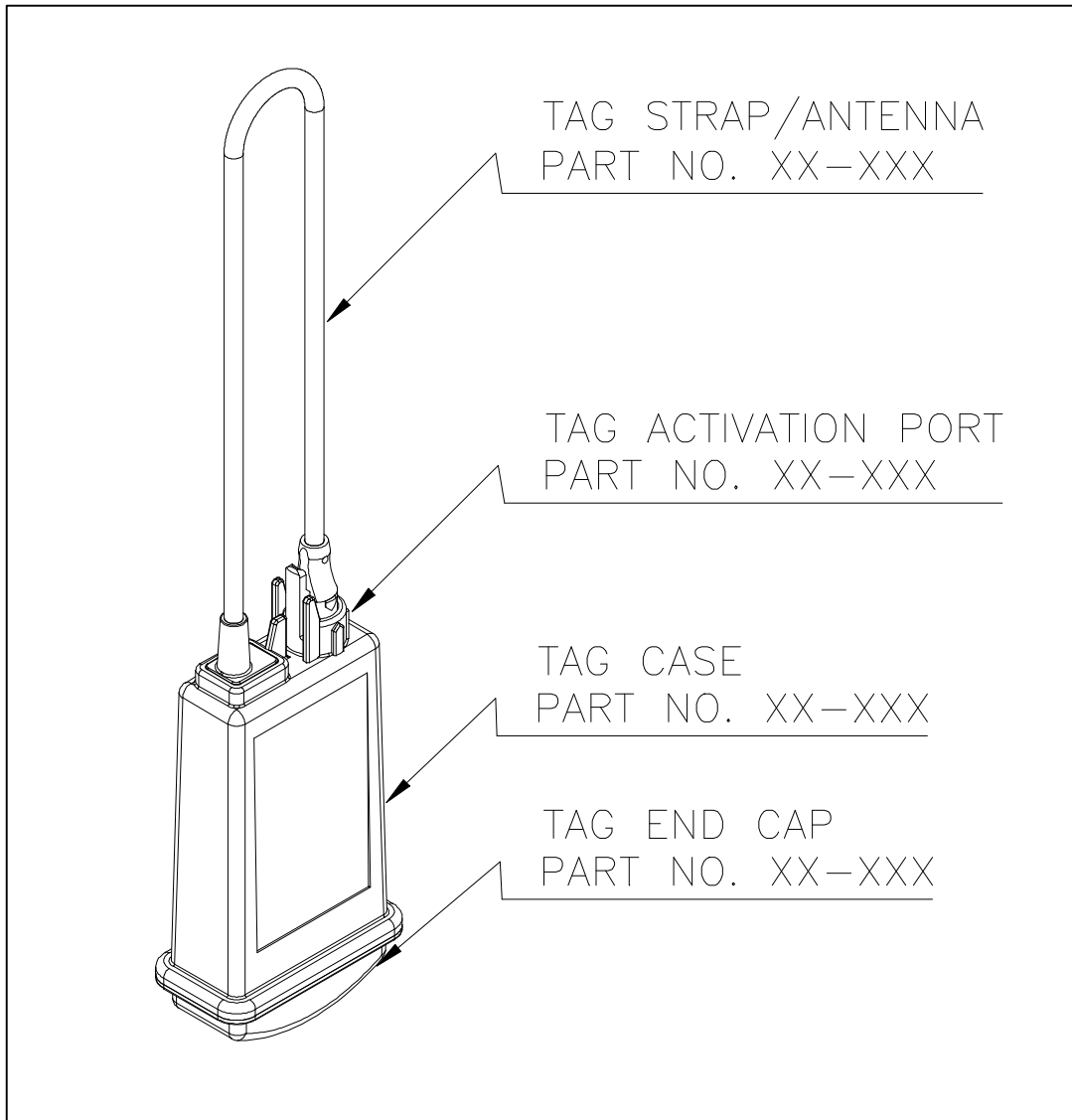
DEMO OR REPAIRS

- Leave tag attached to equipment

SOLD

- Remove strap by pushing the release lever fully to the left, pulling the strap out of the connector. (Leave the strap disconnected.)
- The light will start blinking once every 2 seconds for twenty-four hours.
- Once the light has stopped blinking, the tag will be ready to reuse.

Tag Schematic Diagram & Parts List



MicroCell



MicroCell Function

An RF receiving device installed at dealerships and resellers to detect and monitor the tagged products at the site. To ensure sufficient coverage, multiple MicroCells may be linked together (via wire LAN) within a dealership. The MicroCells report their data to the On-Site Controller (OSC).

MicroCell Model Numbers

Automated Inventory Control System (AICS) MicroCells are identified by serial number and the following model number:

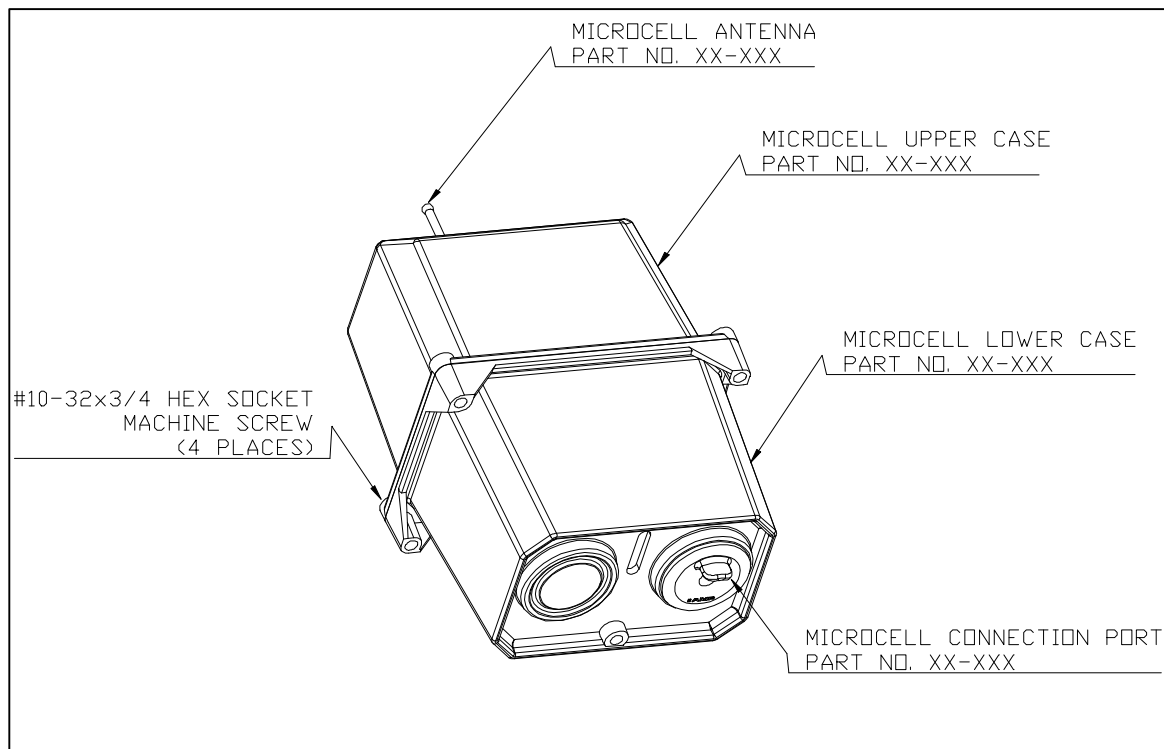
GSAM-CEL-01.

The last two digits of the model number indicate the manufacturer's version of the device.

MicroCell Diagnostic Lights

LED NUMBER	COLOR	FUNCTION
D5A	RED	Power ON
D5B	YELLOW	LAN Activity (transmitting collected data)
D5C	GREEN	Receive Status 1
D5D	RED	Valid Signal Rec'd (until polling ends)

MicroCell Schematic Diagram & Parts List



On-Site Controller



On-Site Controller Function

A microprocessor based data storage device installed at dealerships and resellers to communicate with the MicroCells and store the tag data until polled from the Host computer.

OSC Model Numbers

Automated Inventory Control System (AICS) On-Site Controllers are identified by serial number and the following model number:

GSAM-OSC-01.

The last two digits of the model number indicate the manufacturer's version of the device.

OSC Diagnostic Lights

LED NUMBER	COLOR	FUNCTION
D6A	RED	Power ON
D6B	YELLOW	LAN Activity (any port)
D6C	GREEN	Modem connection made; on-board memory being accessed
D11	YELLOW	LAN Activity (port 0)
D12	YELLOW	LAN Activity (port 1)
D13	YELLOW	LAN Activity (port 2)
D14	YELLOW	LAN Activity (port 3)

Maintenance Procedures

Principles of Operation

The system is a radio frequency (RF) based inventory system which allows users to access inventories held at remote sites. The installed system consists of an On Site Controller (OSC) and 3 MicroCells. The overall system also includes RF transmitters and a HOST software package. The system operates in the licence exempt 902 - 928 Mhz frequency band and will not interfere with any electrical equipment operating in the area.

Installation Guide

Installation Checklist

- Define Project Goals**
- Assign Project Manager**
- Define Customer's Goals**
 - Is the customer familiar with the installation plan, how it will look and the function of the equipment?
 - What level of detail does the Customer require for drawings and schedule?
 - Establish Customer's chain of authority and approval procedures for the initial order and any changes or requests during the installation period.
 - Exchange business contact numbers with Customer's person responsible for the Project
 - Are local building and electrical codes involved?
 - Does the customer have any special requirements beyond the applicable code (shielding, conduits, etc.)?
 - Is the switching of power sources required for machinery and computer equipment?
 - Obtain building/wiring drawings for modification and approval by Customer and local authority.
 - Are special insurance considerations required?
 - Define final Customer Acceptance parameters.
- Define Installation Schedule**

- Obtain required local regulatory approval
 - Coordinate with other contractors for their impact on the schedule.
 - Are there time (day/night/scheduled power outages) restrictions?
 - Are security passes or parking passes required for entrance to the facility?
 - Establish time-lines with milestones for:
 - Site Preparation
 - Delivery of Materials
 - System Installation
 - Installation Testing
 - Training Period.
 - Provide copy of schedule for Customer and regulatory authority.
- Define Installation Logistics**
- Who is the Customer's on-site person in-charge? Schedule meeting to discuss communication/problem-solving.
 - Is material to be delivered to and accepted by Customer at the site?
 - Is there a secure location for the storage of material?
 - Is the customer supplying any material (wire, cabinets, etc.)?
 - Is there any specialized equipment required? Who is supplying it?
 - Are any exceptional precautions required for safety in the work environment?
 - Are there any special waste services required?
 - Are there labor union contractual considerations?
 - Are regulatory inspectors required to be present during installation?
 - Provide regularly scheduled updates to installation schedule.
- Define Commissioning, Training and Customer Acceptance**
- Is training required before customer acceptance? Establish mutually agreed upon schedule.
 - Establish training curriculum and resource materials.
 - Who is required to be present (Customer and regulatory personnel) for final Customer Acceptance?
- Define Billing Procedures**
- Is the Customer to be billed separately for the installation? Establish terms.
 - Is the Customer to be billed separately for the training? Establish terms.
 - Is the invoicing to be done after certain stages of completion? Establish milestones and dollar values.
 - To whom are the invoices to be addressed? Determine what information the customer requires on the invoices.

Installation Procedures

Principles of Operation

The following is a quick reference guide to the installation of Gemstar's Inventory Control System. For installation, you will need the following tools: RJ 11, RJ 45 crimping tool, drill and drill bits, 11/32 wrench, Robertson screwdriver, wire strippers.

Shipping Dimensions

Length: 35 cm (14")
Height: 45 cm (18")

Width: 35 cm (14")
Weight: 30 Kg (66 lbs.)

Contents

Inside the kit you will find the following:

- 3 - Tuned Antenna
- 3 - MicroCells and Mounting hardware
- 3 - RJ 11 jacks
- 3 - RJ 45 jacks
- 1 - On Site Controller
- 1 - 24V AC wall mount transformer
- 1 - 9V AC wall mount transformer
- 1 - Phone Extension line
- 1 - Box of 22 awg 4 conductor solid wire

If any of the parts are not in the kit please call **Technical Support at (905) 847-3832**.

CAUTION

Do not attempt to substitute any of the power supplies. Severe damage may result.

Site Location Plan

From the site drawings provided by the Customer, Gemstar will construct a detailed Site Location Plan, which will ensure the following:

- Adequate approved power outlets exist for the equipment
- On-Site Controllers are located to provide continuous coverage
- On-Site Controllers are located away from interference-generating equipment
- Wiring routes are acceptable to Gemstar and the Customer

Installation

The following is a step-by-step installation guide for the system:

1. Locate the mounting area for the MicroCells and OSC.
2. Using provided mounting hardware mount all MicroCells and OSC
3. Run the provided wire from the OSC to each MicroCell using the home run wiring configuration.
4. Attach the provided RJ 45 jacks for the OSC as per wiring diagram, do not plug in at this time.
5. Attach the provided RJ 11 jacks for the MicroCells as per wiring diagram, do not plug in at this time.
6. Connect the OSC RJ 45 Jacks.
7. Connect the phone line provided from the OSC to the phone jack.
8. Connect the transformers from the 120 V AC to the appropriate jacks in the OSC. (Connect the smaller transformer first).
9. Ensure the green power light located at the bottom of the OSC is on.
10. The red LAN indicator light will start flashing at approximately 1 second intervals.
11. Once the above are completed, you can now connect the MicroCells. When plugging in the MicroCells, ensure the green power light is on and the red LAN indicator light is flashing approximately once every 5 seconds.
12. The system should now be fully operational. The final step is to obtain an authorization number from Gemstar. Please call the following number for authorization: (905) 847-3832.

Block Diagram of Tag RF and Modulating Circuitry

See Appendix A for the Asset Tag RF and Modulating Circuitry diagrams.

Block Diagram of MicroCell RF and Modulating Circuitry

See Appendix B for the Asset Tag RF and Modulating Circuitry diagrams.

**Block Diagram of On-Site Controller RF and Modulating
Circuitry**

See Appendix C for the On-Site Controller RF and Modulating Circuitry diagrams.

Performance Specifications

Tag

Tx Frequency	902-928 MHz
Power Output	10-75 mW
Bandwidth	480 KHz
Data	32-bit with CRC, 8-bit digital, 8-bit analog
Power Source	6V Lithium internal battery
Battery Life	2 years
Antenna	Self-contained or external monopole
Size	13cm X 8cm X 3.5cm (self-contained) 27cm X 8cm X 3.5cm (external antenna)
Temp. Range	-40°C to +65°

MicroCell

Rx Frequency	902-928 MHz
Sensitivity	-100dbm
Range	0-2km radius (application specific)
Bandwidth	600 KHz
Data	32-Bit with error correction
Power Source	External 24V AC
Antenna	8" monopole with tnc mount
Size	37cm X 12cm X 8cm (with antenna)
Temp. Range	-40°C to +65°

On-Site Controller

Memory	256 KB (expandable to 1 MB)
Power Source	120V AC
MicroCell Capacity	16 cells
Tag Capacity	600 (expandable to 2400)
Modem	14.4 kbps with V.32
Size	30cm X 23cm X 6cm
Temp. Range	-40°C to +65°

Host Computer Requirements

Operating System	Windows 3.1 or Windows 95
Processor Speed	486 DX2 – 66MHz or faster
Memory	8MB RAM minimum
Video	256 VGA or higher
Digital Device	Mouse
Modem	14.4 kbps with V.32

Notice to Users

This notice is required to be provided to the user where it is not practical to display on the equipment components.

***This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) this device may not cause harmful interference and
(2) this device must accept any interference received, including interference that may cause undesired operation.***

NOTE

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

WARNING

Changes or Modifications not expressly approved by Gemstar Communications Inc. could void the user's authority to operate the equipment.

When the equipment will be used in Canada, the following notice applies:

NOTICE

This digital apparatus does not exceed the Class A/B limits for radio noise emissions from digital apparatus as set out in the interference-causing equipment standard entitled "Digital Apparatus", ICES-003 of Industry Canada.

Cet appareil numerique respecte les limites de bruits radioelectriques applicables aux appareils numeriques de Classe A/B prescrites dans la norme sur la materiel bouilleur: "Appareils Numeriques", NMB-003 edictee par le ministre Industrie Canada.

Technical Support

Service Standards

This section will detail the following items to be contained in the service agreement.

Period of the Agreement

Define the term of the agreement.
Define the term of warranty of the equipment for parts and labor.
Define the date the warranty begins (final acceptance?).

Responsibility

Define the maintenance tasks for which the Customer is responsible.

Define the maintenance tasks for which this agency is responsible.
Define the training and resource materials which will be provided to the Customer.

Service Calls

Establish the person(s) at the Customer's site who is authorized to initiate service calls.

Establish the person(s) at the Customer's site who is authorized approve the maintenance work.

Establish the contact numbers for this agency and the Customer.

Establish the response time that will be satisfactory (same hour, same day).

Establish periods when advance notice may be required (eg. rush hour).

Establish the hours of service (evenings, holidays).

Define specialized tools required for the work and who will provide it.

Billing

Establish the frequency of the billing and the payment terms in days.

Establish the billing address and department responsible.

Define the information to be included on the invoice.

Service Outside of the Contract

If service is requested that is not covered by the contract, establish who is authorized by the Customer to approve the quotation. Establish whether or not there is a dollar limit on this approval authority.

Documentation

Establish details required for Service Reports and distribution of copies of same.

Establish reliability tracking/quality assurance audit procedures and forms.

Safety and Security

Define hazardous work areas and establish protocols to ensure safety of maintenance personnel.

Acquire security passes for relevant personnel.

Troubleshooting

The troubleshooting section is under development and will be issued with the first production release of this manual.

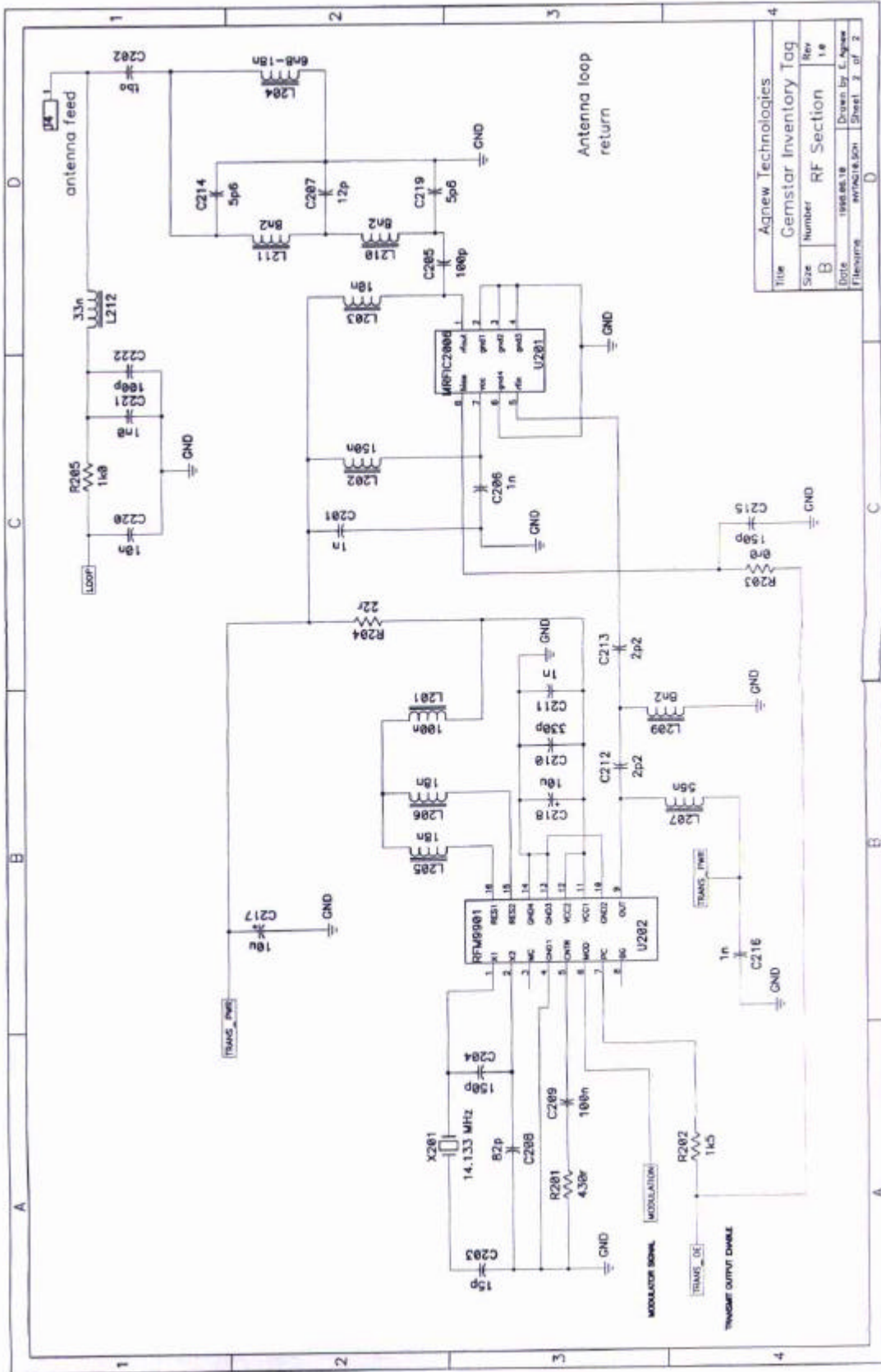
Index

- AICS
 - definition, 1
- Asset Management, 1
- Asset Management Tags. See Tag
 - duty cycle, 2
- Asset Tag. See Tag
- Asset Tracking
 - overview, 1
- Automated Inventory Control System (AICS), 1
- billing procedures, 15
- commissioning, 15
- Connection Mode, 3
- contents
 - installation kit, 16
- Copyright, i
- customer acceptance, 15
- customer's goals, 14
- diagnostic lights
 - MicroCell, 11
 - On-Site Controller, 13
 - Tag, 8
- Duty Cycle, 2
- frequency, 2
- host computer
 - specifications, 20
- Host Computer
 - overview, 1
- installation
 - tools, 16
- Installation, 17
- installation checklist, 14
- installation guide, 14
- installation kit
 - contents, 16
- installation logistics, 15
- installation procedures, 16
- installation schedule, 14
- inventory
 - missing, 2
 - sold, 2, 8
- Inventory
 - overview, 2
 - label, 5
 - location, 6
- LAN activity, 13
- maintenance
 - troubleshooting, 23
- maintenance procedures, 14
- MicroCell
 - description, 10
 - diagnostic lights, 11
 - function, 10
 - overview, 1
 - parts list, 11
 - schematic diagram, 11
 - specifications, 19
- missing inventory, 2
- model number, 8
 - MicroCell, 10
 - On-Site Controller, 12
- Model Number, 1
- network
 - MicroCell, 2, 10
- Normal Mode, 3
- notice label, 5
- Notice to Users, 20
- On-Site Controller
 - description, 12
 - diagnostic lights, 13
 - function, 12
 - overview, 1, 2
 - specifications, 19
- OSC. See On-Site Controller
- performance specifications, 19
- power supplies, 16
- principles of operation, 16
- project goals, 14
- project manager, 14
- Radio Frequencies, 2
- Regulatory Approval Label Diagram, 5
- RF and modulating circuitry
 - block diagrams

- MicroCell, 18
- Tag, 18
- RF Power Output and Field Strength, 2
- Server. See host computer
- service
 - billing, 22
 - documentation, 22
 - period of the agreement, 21
 - responsibility, 21
 - safety and security, 22
 - service calls, 22
 - service outside of the contract, 22
- service standards, 21
- shipping dimensions, 16
- signal transmission, 2
- Site Location Plan, 16
- sold inventory, 2
- Sold/Disconnect Mode, 3
- specifications, 19
- System Block Diagram, 4
- System Description, 1
- Tag
 - attachment and test procedure, 8
 - code, 7
 - description, 7
 - diagnostic lights, 8
 - function, 7
 - model number, 8
 - overview, 1
 - parts list, 9
 - schematic diagram, 9
 - specifications, 19
 - status, 7
- Tags
 - transmission, 2
- technical support, 16, 21
- Time Lines, 2
- tools
 - installation, 16
- Tracking
 - overview, 1
- Trademarks, i
- training, 15
- Transfers, 2
- transmission, 2
- troubleshooting, 23
- Use and Purpose, 2
- User Comments, i

Appendix A

Block Diagrams of Asset Tag RF and Modulating Circuitry



Appendix B

Block Diagrams of MicroCell RF and Modulating Circuitry

Appendix C

Block Diagrams of On-Site Controller RF and Modulating Circuitry